G. W. Fleming

POLICE COMMUNICATION SYSTEMS

Beat telephone equipment in use. Note folding writing platform; also combined receiver and transmitter set.

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Police Communication Systems

BY

V. A. LEONARD

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CONTENTS

ILLUSTRATIONS

FOREWORD

When in 1930 the Bureau of Public Administration of the University of California inaugurated a program of research in public administration, its initial emphasis was directed to the administration of criminal justice as one of several major fields in each of which specialists in particular aspects of that subject would coöperate in a series of related research projects. Since that time a bibliography of crime and criminal justice since 1926 has been compiled, and studies dealing with the incidence of delinquency in Berkeley, 1928–1932, judicial criminal statistics, the prosecutor's office, the public defender and private defense attorneys, and California prison population, 1902–1934, have been made by members of the staff. Since 1930, also, studies in police administration, including *The Police and Modern Society*, published in 1936, *Crime and the State Police,* published in 1935, police communication systems, traffic engineering, and criminal investigation, have been conducted under the direction of Professor August Vollmer.

The Bureau of Public Administration presents this volume, *Police Communication Systems,* by V. A. Leonard, as the fourth of its publications in the group dealing with the administration of criminal justice.

Samuel C. May,
Director.

PREFACE

THE INFORMATION contained in this book is from reliable sources. Fiction and questionable opinions have been replaced by facts. Very early in the course of the work, it was found necessary to reject a large mass of information represented by popular accounts of feats performed by police teletype and radio communication, because this information was not dependable. Data collected at random in the past nine years have been supplemented by systematic inquiries directed to important centers in the United States, Canada, and the majority of foreign countries, in an endeavor to establish connection with satisfactory sources of information. In addition to some 3000 questionnaires forwarded, more than 1000 original typewritten letters were placed in the mails, and these were supplemented by personal investigation and interviews wherever possible.

The labor of pioneering the way into a new field of inquiry would have been exceedingly difficult but for the ardent interest and coöperation extended by a host of friends. The inspiration and counsel of August Vollmer (formerly Chief of Police of Berkeley, California, and later Professor of Police Administration in the University of California), under whom I served as a police officer for eight years, were the prime factors in its inception and subsequent development.

The reader will find no difficulty in entrusting his confidence to Chapter X, "Police Communication under Disaster Conditions," and Chapter XIII, "Foreign Police Communication Systems," which represent the results of extensive inquiry by Mr. Milton Chernin, Research Associate in the Bureau of Public Administration, University of California. The advice and counsel of Lieutenant-Colonel J. O. Mauburgne, U. S. A., Ninth Corps Area, in charge of military communications along the Pacific Coast, were of great assistance in the preparation of the chapter dealing with the operation of the police communication system under disaster conditions; the discussion of this subject is in large measure a reflection of his ex-

pert opinion in this field. In the assembling of material for Chapter XIII, I am heavily indebted to the Department of State and the Consular Service for their efforts in obtaining with extraordinary completeness detailed information concerning the framework and characteristics of police communication systems in all major foreign capitals.

The list of persons who have assisted in my undertaking is extremely large, yet it would be difficult to close without at least an expression of thanks to a few of them. These include J. A. Greening, Chief of Police of Berkeley, California, whose advice and coöperation were of great value throughout the entire project. Lieutenant Kenneth R. Cox, formerly of the Detroit Police Department (now communication officer at Berkeley, California), and undoubtedly the principal American authority on the police radio system, generously lent of his time and expert knowledge. Thanks are due Professor Bert Wentworth and J. Edgar Hoover, Director of the Bureau of Investigation of the United States Department of Justice, Washington, D. C., for their assistance in presenting Chapter XI, on communication and the problems of distant identification.

Mr. F. C. Brandeburg, commercial representative of the Pacific Telephone and Telegraph Company, San Francisco, and the members of the eastern staff of the Bell Telephone Laboratories, manifested an unusual degree of coöperation in placing at our disposal information hitherto unpublished concerning the use of the telephone and the teletypewriter in police service. Mr. Gustav F. Bauer, of the National Police Signal Company, Buffalo, N. Y., supplied invaluable technical data with reference to the installation of telephone and recall equipment on the police beat. The Holophane Company, Inc., the National Radio Institute, the Corning Glass Works, the American District Telegraph Company, the Western Union Telegraph Company, the Pacific Radio Trades Association, and others, were generously helpful.

Credit is due Professor Samuel C. May, Director of the Bureau of Public Administration, University of California, for

the financial assistance which made possible the publication of this material, as well as much of the work entailed in collecting and organizing it for presentation. I am obligated also to Mrs. Muriel Hunter, of the Bureau of Public Administration staff, who labored industriously in the final preparation of the manuscript for publication.

In a treatise of this kind, a basic principle of police operation must not only be recognized, but must also, because of its importance as a "base-line" for the discussion, be given definite expression. It is this: Performance in emergencies is taken throughout as the criterion for all communication activities; since, if a crisis can be met, the accommodation of routine business must follow as a matter of course.

V. A. Leonard

INTRODUCTION

THE CHOICE of communication facilities for the administration of police departments is dependent, in large measure, upon the means of transportation and of transmitting messages that are available to the criminal world. It is essential to successful police operation to "keep one jump ahead of" criminals in all manner of equipment, because these enemies of public order take advantage of every new device which may assist them in the pursuit of their lawless occupations. The earliest police organizations employed simple methods of communicating with their various members, utilizing little more than the military sentry-to-sentry calling system. Although such measures seem crude in comparison with the systems in use today, they served their purpose, for the criminal had no instruments for conquering time and space superior to those available to the officers of the law. As transportation and communication facilities improved, however, it became necessary for the police to avail themselves of the new equipment in order to cope with the criminals who seized upon these inventions to further their own purposes.

With the introduction of the automobile, and its increasing utilization by all members of society, rapid communication service became absolutely indispensable to law-enforcement officials. The necessity has mothered many inventions, and now there is no lack of scientific methods which may be employed by the police in the apprehension of lawbreakers. Through the modern telephone system, direct contact is possible between the citizen and the police; various other media convey the reported information from the central station to the patrolmen. By means of motorcycles and high-powered automobiles, the man on the beat is able to reach the scene of the crime or pursue the criminal. If the perpetrator escapes beyond the limits of the local jurisdiction, radio and teletype can carry the necessary information to neighboring localities, to the entire state most nearly concerned, or even beyond these boundaries into other states.

The citizen and taxpayer may be interested in the fact that modern equipment, if carefully selected and distributed, will effect an appreciable economy in the operation of a police department. The reserve force which formerly had to be kept at the station house may be dispensed with, for modern signaling equipment will summon the men on the beats for this purpose at a moment's notice. Call cars which are held at the station to respond in emergencies are no longer required, and even the squad cars, still considered essential in some departments, are unnecessary if the patrol cars are properly equipped. Rapid concentration of the available forces at any point and at any time is possible through modern communication instruments.

Every community, however small or large, has within its confines the foundations of a police communication system. The factory whistle, the lighting facilities of the municipality or county, amateur wireless stations, and the telephone and telegraph services may all be used, separately or collectively, by the policemen in fulfilling the intercommunication needs required in giving aid to the people they serve.

Unfortunately, the police have been handicapped in their efforts to plan efficient communication systems by a lack of published works on the subject. Every department has been forced to struggle with the solution of its communication problem independently; little or no opportunity has been offered for one organization to become acquainted with the practices and equipment employed by others and thus to profit by their successes and failures. Large sums of money and much effort have been wasted in fruitless and repetitious experimentation which might well have been avoided if the accumulated knowledge in this field had been available.

Too long have the police employed this trial-and-error method in attacking their communication problem. Scientific practices and principles have been developed in other branches of the police service with marked results. Criminal identification, for example, is no longer a guessing contest: it is an exact science. Scientific investigative methods have

been introduced into the police service, skilled technicians are now employed in police departments to conduct scientific crime-detection laboratories, and a substantial body of reference works has been developed in this field, to which other scientists are constantly contributing. In recent years, the traffic problem also has been scientifically attacked, and accurate measures may now be used to determine what must be done in planning for the control of traffic.

It is timely and important that the scientific achievements of communication experts in every part of the world should be critically reviewed and presented in such form that their special knowledge may be made available to police and public officials. The rapid advances which have been made in communication methods are traceable to the individual efforts of countless persons in every section of the globe. What the policeman uses in China may not necessarily be applicable elsewhere, but it may contain the germ of an idea which, associated with other ideas, may prove enormously useful in improving the service of some other country. Engineers everywhere have contributed greatly toward the improvement of the communication branch of police service by supplying ingenious devices and efficient methods. Visual and audible signals, street and office telephone systems, departmental and interdepartmental teletypewriter service, secret alarm devices, and the radio all contribute valuable assistance to the officers of the law, and, paradoxically, reduce the cost of police service to the taxpayer.

In his description of the problem encountered by police in the communication field and in his presentation of the instruments, practices, and techniques employed by police in this country and abroad, Mr. Leonard has supplied public and law-enforcement officials with a much needed tool. By the critical manner in which he has treated the material, he has added another police function to the list of those that are now in the hands of scientists. From this summary of the many methods available to police organizations, it is evident that, from now on, no communication system should be installed

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until the installation plan has been carefully studied and approved by specialists.

The future is filled with great possibilities. Even today the developments in this science are so rapid that it is impossible to present every new invention and practice in any book. Radio and television are only in their swaddling clothes, and, according to the best-informed men, there will be varied and rapid advances in all phases of communication technique. Mr. Leonard has made a valiant effort to include all the latest devices offered for police use, but it may be that some have been neglected. It will always be necessary for the police to be alert for new developments in order to combat with superior methods and superior equipment the efforts of the criminal to fasten himself parasitically upon our society.

August Vollmer

Chapter I

THE BEGINNINGS OF MODERN POLICE COMMUNICATION

In the modernization of police departments probably the factor that has played the greatest rôle is communication. The history of its development is not a long and continuous one, for the ancient Greeks and Romans communicated with as great facility as did George Washington. Furthermore, it was not until the British Parliament was led to enact the sweeping reforms of Sir Robert Peel in 1828 that police organization became coherent enough to make use of formal communicative facilities. Peel's reforms established an agency the development of which thereafter could parallel closely the advancement in scientific communication. This first professional police force, of uniformed constables, had a day-and-night responsibility for keeping the peace and apprehending lawbreakers. In 1845 New York set up a force like London's; and other American cities soon followed the example of New York.

Adoption of the Telegraph

Almost coincidentally with the establishment of professional police departments came the application of the electric telegraph to police communication. The Wheatstone and Cooke telegraph had been installed on most of the English railroads in the years between 1837 and 1842, and not long after the telegraph was completed on the Great Western road its usefulness in police operations was dramatically demonstrated. A murderer, fleeing from his crime, boarded a first-class carriage at Slough, eighteen miles from Paddington. Once in the carriage, in a train moving rapidly toward London, the man breathed freely, for escape seemed certain. He reckoned without the telegraph, which had already borne to London the news of the murder and a description of the fugitive. Within three minutes, a return message announced to the local officials the arrival of the train and the arrest of the murderer.

The publicity given to this incident had results which were felt in police circles. In 1846, the Central Police Station at Scotland Yard was connected by wire to the Central Office of the Electric Telegraph Company, and shortly afterward the district police stations also were thus connected to it.

The development of district telegraph service in London and of telegraph communication exchanges in various cities of the United States[1] enabled citizens to get in touch with the police stations; this use of the telegraph, however, never became of great importance in police service. The rapid construction of telegraph wires between important cities also provided means by which police forces in various parts of the country could have coöperated in police matters; but they did not do so. It was not until after the formation of the International Association of Chiefs of Police in 1893 that the provincialism and exclusiveness of the numerous American police forces began to be broken down. In fact, the lack of coöperation between police departments in the war against crime was one of the main causative factors which led to the setting up of this association.

When the telegraph was first utilized by police departments, the practice was to employ telegraph operators at headquarters, as members of the force, to transmit and receive the Morse signals. In 1858, the firm of C. T. and J. N. Chester constructed, for the New York City Police Department, a dial telegraph which enabled policemen who did not know the Morse code to send messages over the wires. Through its use the police did good work in the draft riots in New York in 1863. The use of the dial telegraph was adopted rapidly by other forces. In an address delivered before the International Association of Chiefs of Police in 1903, Chief Francis O'Neill, of Chicago, gave a notably good description of these instruments:

"The introduction of electricity as a means of communication between stations was the first notable advance in the improvement of police methods. Not many here will remember

[1] A. E. Costello, *Our Police Protectors*, p. 31.

the time when the manipulation of the dial telegraph by the station-keeper while sending messages excited the greatest wonder and admiration. The alphabet and numerals in two concentric circles were so arranged that the operator spelled out the words by pressing the buttons. The finger or arrow in the center of the dial rattled noisily around and pointed out on both instruments (the sender and receiver) the numbers or letters indicated by the touch of the station-keeper.

"So little was the means of sending messages by telegraph understood that, on one occasion, a cabman rushed into a Chicago Police Station, and, handing the station-keeper a written description of his rig which had just been stolen, urgently requested that a message be sent immediately to all stations. The latter took the slip of paper and put his instrument in connection with its destination and after spelling out the message on his dial, hung on a spindle the piece of paper which the cabman had given him. The man lounged around for some time, evidently restless and unsatisfied. At last his patience was exhausted and he belched out, 'Ain't you going to send that dispatch?' The station-keeper politely informed him that he had sent it. 'No, you hain't,' replied the indignant man, 'there it is on the hook.' "[2]

The desire for speed caused the police to readopt the Morse code after using the dial for a generation. "The dial was superseded by the ticker in Chicago in the year 1876, and all station-keepers, who were by this time called desk sergeants, were required to take up the immediate study of the Morse system of telegraphy."[3]

Although the telegraph was adopted for communicating between the precinct stations and central headquarters before the middle of the nineteenth century, the problem of communication between the patrolman on the beat and the precinct station received little consideration until the 1880's. Each shift of patrolmen was assembled at its precinct station before going on duty, the orders of the day were read, and the

[2] *Proceedings of the International Association of Chiefs of Police,* 1903. [3] *Ibid.*

men were then marched to their beats by their roundsman. From that time until the end of the shift each patrolman was essentially dependent upon his own resources and isolated from the rest of the force except at periodic meetings with the roundsman or patrol sergeant.

The disadvantages of this system were obvious. There was no way of knowing whether the patrolman was diligently patrolling his round, for every popular officer was promptly informed by his friends on the beat of the near approach of the roundsman. Neither was there any way of making available to the officer such information of happenings on his beat as might be reported to the precinct station. Nor was an officer available in the event of an emergency, unless he happened by extreme coincidence to be at the scene of that emergency. If an officer on a beat needed help from his fellow policemen, he had great difficulty in getting it. He could use his voice, whistle, or baton as a distress signal, but unless another officer was within earshot such signals were ineffective. If he succeeded in arresting a dangerous or unruly person he entered a new realm of trouble, for there were no police conveyances which he could summon to take the prisoner to the station and no means of calling such a convenience, even if it had existed.

The lack of means of communication between the precinct station and the patrolman cannot be explained by the nonexistence of apparatus for this purpose. Telegraphic fire-alarm signal systems, which could have been adapted to police operations, had been in use in the United States since 1851. In fact, Dr. W. F. Channing suggested the use of the telegraph for fire-alarm purposes as early as 1839, when the telegraph itself was a crude instrument. Nothing came of this suggestion, however, until after the publication of an article by Dr. Channing in the Boston *Advertiser* in 1845, in which he outlined a method of applying the telegraph to fire alarms. In the winter of 1847–48, Moses G. Farmer carried out this suggestion by constructing the first machine for giving an electric fire alarm. In 1851, Dr. Channing and Professor Farmer installed a fire-alarm system in Boston, based on the

former's original proposal; it consisted of numerous box stations, connected by telegraph circuit with the central office, from which all alarm signals received from the boxes were sent out over other circuits to the bell towers, so that the signal from the box would be simultaneously struck, electrically, by every fire-alarm bell in the city.

Although New York City officials had experimented with the idea of adapting the telegraph to fire-alarm purposes between 1846 and 1850, nothing permanent had come of their work. For the evolution of the practical machinery required for this purpose, credit must be given to the joint efforts of Dr. Channing and Professor Farmer. Their patents were acquired in 1855 and 1859 by John N. Gamewell, of South Carolina, who devoted the rest of his life to the development of fire-alarm and police signaling systems. The Boston system with some improvements was adopted by Philadelphia in 1855. St. Louis signed a contract for it in 1856, although the plan was not used until 1858. New Orleans and Baltimore adopted the system in 1860, but the Civil War seriously arrested the development. New York City did not adopt an electric fire-alarm system until 1869.

Between 1852 and 1881, 106 electric fire-alarm systems were installed in the United States, and by 1881 these systems had reached a high stage of mechanical development.[4] Few police forces had anything like them. The fundamental reason for this lag in police-communication development lies in the historic conception of the police function and the basic differences between police and fire organization. For centuries, people had thought of police work in terms of the petty constable or sleepy night watchman walking his round. The uniformed patrolman was merely a more efficient night

[4] In 1902, the United States Bureau of the Census published a *Survey of the Electrical Industry of the United States* (*Bulletin* No. 11), which deals with municipal electric fire-alarm and police-patrol systems. This report gives in detail the number of installations of police and fire-alarm signals year by year from 1852 to 1902. By 1866 the fire-alarm signal boxes in Boston were automatic. In 1867 the automatic features were improved, and in 1869 the "noninterference pull" was invented, which prevented interference with a signal being sent in from a box.

watchman. What need was there for other police equipment than a badge and club, a pair of handcuffs and a whistle? The chief duty of a policeman was thought to be making the round of his beat, suppressing crime by his presence, and apprehending such criminals as he might, by extreme coincidence, "catch in the act." The need for a complex communication system which would serve as the central nervous system of a highly integrated organism for the suppression and prevention of crime was not perceived until after police organizations began to move from under the rigid control of political officials. With the introduction of some measure of civil-service reform and the consequent development of the idea that police work was a specialized profession, police communication began to receive the attention it deserved.

Basic differences between the centralized organization of the fire department and the dispersed organization of the police department also assisted in the diverse development of their respective communication systems. Firemen were centrally situated in their stations, not patrolling the streets looking for fires to put out; it was essential, therefore, to bring the news of a fire to their notice in the shortest possible time; the dangers of delay were obvious to the most indifferent person; the need for electric fire-alarm systems was easily perceived and their adoption easily procured. The need for electric police communication was not so obvious. Policemen were constantly walking their beats and were supposed to come upon the criminal while he was committing a crime. A person who needed a policeman could either run to a police station or take the chance of meeting one on the street. Delay in informing the police of a crime report did not seem of such great importance. The adoption of police communication equipment was therefore greatly delayed.

Adaptation of telegraphic fire-alarm boxes to police purposes was early undertaken by the Gamewell Company and others. The first electric police-communication system of record was installed in 1867. Between 1867 and 1882 only seven more systems were put in operation. After this rather slow

beginning, however, installations became more numerous: 56 systems were installed from 1882 to 1891, 76 systems in the next decade, and 84 new installations were made in the years from 1892 to 1902. When the census of municipal electric fire-alarm and police-patrol systems was taken in 1902, reports were received from 148 electric police-patrol systems. Of the total number, 125 were exclusively signaling systems, 19 were exclusively telephone systems, and 3 were a combination of these two. (The remaining system reported only "telegraphing boxes.") Although the systems were well distributed among cities of various sizes, the communities of 100,000 population and more had so large a proportion of the equipment that the use of police boxes was obviously still limited to the larger metropolitan centers. In fact, 68.6 per cent of the signal boxes and 68.2 per cent of the telephone-system boxes were in cities of 100,000 and more, with only 3 per cent, and 0.7 per cent, respectively, in cities of less than 10,000. Cities of the largest class (100,000 and more) received and sent 77.7 per cent of all police calls and 87.3 per cent of telephone messages.[5] "Thus," stated the Census report, "there appears to be a large field for the introduction of telephones for police service in the smaller communities, where they would be most useful, the number of officers being few and the population and dwellings being sparsely scattered over a large area."

The first police boxes utilized telegraphy and established one-way communication between the officer on the beat and the precinct station. The apparatus consisted of electric signal mechanisms which were placed at stated points along the route of the beat patrolman and were connected by suitable circuit wires to headquarters or the precinct station. Some

[5] The Census figures show the following result.

Number of cities having systems	Per cent of total	Population
34	23	More than 100,000
30	20.3	50,000 and less than 100,000
39	26.3	25,000 and less than 50,000
33	22.3	10,000 and less than 25,000
12	8.1	Less than 10,000

of the boxes were simply placed against a wall or on a lamp post, but even early practice favored specially constructed booths on the curbs or at street corners, in which signal boxes were placed. As subsequently improved, the apparatus enabled the policeman on his beat to send a variety of signals to his headquarters. An ordinary duty call, which he was required to make every hour, could be sent by merely opening the box with a specially constructed key. This automatically registered the number of the box, together with the time, on a tape in the terminal apparatus at headquarters. Other signals, such as wagon calls, ambulance calls, and calls for help, were sent by opening the inner door of the box, setting a pointer at the required call, and pulling the releasing mechanism. For this purpose, signal boxes were manufactured which accommodated seven or more different calls. In Berkeley, Calif., for example, prior to replacement by other equipment, boxes were employed by which it was possible to transmit to headquarters seven types of call, including three report calls for the three patrol shifts and four emergency calls—fast wagon, slow wagon, ambulance, and telephone. At headquarters the receipt of these emergency signals on the tape was usually accompanied by the ringing of a bell or the flashing of a light, which ensured prompt attention to them.

Originally, these boxes seem to have been used only in outlying districts, where beats were large and patrolmen widely separated from each other. A description of the various precincts of New York City in 1884 mentions telegraphic police boxes as being used only in such precincts. Thus, in describing the Thirty-second precinct, Costello says "This is a mounted-police precinct and even the horsemen are aided by boxes from which they can send necessary signals to the station house."[6] The Thirty-fifth precinct "is a mounted one, with boxes for signals from far-off parts."[7] The utility of these boxes and the even greater need for them in busy parts of the city soon became apparent, and their use was no longer limited to outlying districts.

[6] *Op. cit.*, p. 388. [7] *Ibid.*

Thus the introduction of the telegraphic police box ended the isolation of the policeman on his beat and enabled him to utilize the reserve strength and equipment of the whole department in the performance of his duty. It did not, however, enable his headquarters to communicate with him. Nor did it furnish a ready means by which the general public could promptly get in touch with the police in case of need, even though certain reputable citizens along every beat had special keys to the police boxes, by means of which they could send an emergency call to the precinct station and so obtain the services of a policeman. These necessary and desirable features of police communication awaited the invention and commercial introduction of the telephone.

ADOPTION OF THE TELEPHONE

Fortunately, the telephone was invented and perfected about the same time that the police began actively to adopt and install signaling systems. Since the telephone was only in its experimental phases and the telegraph was already well established as a workable police-communication instrument, the telephone for several years remained an auxiliary to telegraph facilities. Police departments, however, did have telephones very soon after exchange service was made available, especially in the smaller towns and cities which had not developed extensive telegraph systems. At first, the police telephone service did not differ greatly from the service as it was used by the public. The metropolitan police in Washington, D. C., subscribed on April 11, 1878, to fifteen telephones, which were installed in eight precinct headquarters, at the home of the superintendent of police, and in headquarters in suburban communities. By 1880, two precincts in New York were listed in the telephone directory, but these were evidently disconnected soon afterward, for they were not listed in the directory for 1882. In the same year, Inspector Byrnes, the newly appointed head of the New York Detective Bureau, established an office in the Stock Exchange Building, which was connected by telephone with every bank and banking

house in the lower part of New York. The speed with which he was enabled to send an officer to any of these places in an emergency contributed in large measure to the decrease of bank robberies in the city.

In 1882, the Brooklyn Police Headquarters was listed in the city's telephone directory, and about the same time, New Brunswick, N. J., had several telephones listed under "Police Department." Brooklyn, according to the evidence, had developed a usable telephone system before any other section in the New York metropolitan area; an editorial in the New York *Tribune* for July 20, 1886, admonishing New York officials for not making use of the telephone as a means of communication, said: ". . . this wonderful invention has been used for six years to connect the police central office in Brooklyn with the police stations . . . and its advantages have been found too great to enumerate. If they [the New York police] wish to keep up with the times, they will put in telephones without delay. Doubtless the time may come when every patrolman's beat will be furnished with one of these instruments, so that the policeman can at once give notice to the station of any occurrence demanding immediate attention."

Apparently, the New York Police Department, acting on this suggestion, made use of the telephone, for the Police report for 1889 mentioned that exchange service connecting the offices of the chief officers of the department at Police Headquarters with each other, with the telegraph office, and with the general exchange system had been in operation for two years, and was used in transmitting a great many messages not requiring a written record.

The telephone was early used to supplement the deficiencies of the telegraphic police boxes and thus establish two-way communication between the station house and the officer on the beat. The evidence seems to indicate that the first combination telegraph and telephone police box was introduced in the city of Chicago in 1880 by J. P. Barret, then superintendent of the electrical department of that city. The system was first installed in one of the most turbulent districts and

at once increased tremendously the efficiency of the force, chiefly in making possible a rapid concentration at any troubled point. Its success was so rapid that by 1893 no fewer than 1000 street stations had been installed all over the city of Chicago, and several hundred private boxes besides. The Chicago installation consisted of a call box in which were placed both signaling apparatus and a telephone. Numbered keys

From an old print; about 1889.

Early methods of police communication and transportation.

which opened any of the stations and boxes were given to the patrolmen of the district and to responsible citizens, whose names were carefully recorded. A citizen's key turned in only a call for help and was locked in the box until an officer arrived to release it. The patrolman's key gave him access to an inner box from which he could transmit calls, signals, and reports by means of the telegraphic signaling apparatus and the telephones.

The value of the police telephone system was dramatically brought to the attention of the public by the prompt capture, through its use, of the perpetrators of a brutal murder. On

the evening of September 2, 1889, Walter Koeller, lying sick in his room in an East Chicago boarding house, was stabbed to death by two young men who called upon him. The landlady, startled by the cries of the victim, ran from the house in search of a policeman, but when she returned with an officer a few minutes later the murderers had fled. The officer rushed to the patrol box and notified his station of the crime, sending a good description of the assassins, which the landlady had supplied, and mentioned the fact that one of them carried a suitcase. A message describing the two men and the nature of their crime was forwarded by headquarters to every precinct in the city, so that in less than an hour from the time of the murder it was known in all police stations. This message was in turn transmitted to every police officer on duty, when he called in to make his hourly report. At eleven o'clock an officer arrested in a railroad yard two suspects who answered the description, and a few hours later Inspector Shea had a full confession of the murder. Thus, by means of a new communication facility, a crime was cleared which might have remained a mystery, for had the men succeeded in leaving Chicago, it is improbable that they would ever have been discovered.

The Chicago system was adopted in Milwaukee in 1883. Brooklyn followed in February, 1884, with many improvements, replacing the unsightly booth by iron boxes, similar to firm-alarm boxes. Philadelphia, however, which also installed its police-patrol system in 1884, adhered to the booth type. Since then, the police patrol-box systems have been extended year by year. With the rapid expansion of telephone service, information relative to law violations was received with less loss of time, and an increasing number of complaints and reports of minor violations began coming in over the telephone. These changing conditions required a gradual but sure improvement in operating facilities in order that the increased traffic might be efficiently taken care of. As we have seen, in 1902 a total of 148 such systems were reported to the Census Bureau. In 1907, there were 226; in 1912, 319; and in 1917, the last year for which we have census figures, there were 428

system, 383 of which were exclusively police-patrol systems and 45 were combined fire-alarm and police-patrol systems.

With the introduction of the private branch exchange, the telephone became the chief communication instrument of the police. Given an instrument capable of transmitting speech, the problem was to devise means whereby correspondents could be placed readily in communication with each other. The earliest application of the telephone necessitated a wire extending from each subscriber to every other one with whom communication was desired. The impossible complexity of such a system became apparent in the earliest days of the telephone, and it was decided to extend the line of each subscriber to a point selected centrally with reference to the entire group and then devise apparatus whereby any pair of subscribers could at pleasure be placed in mutual talking relations. Various forms of switching apparatus were developed in attempts to solve this problem. The first switchboards were limited in capacity and were inadequate for any but the smallest number of subscribers. The first telephone switchboard installed in San Francisco was a crude affair consisting of two boards nailed to brackets on a wall, along each of which was arranged a row of brass clips. Each clip was the terminal of a telephone line, and in the center of each clip a hole was drilled to receive a plug. A connection was made between two subscribers' lines when the proper clips were linked by means of two brass plugs joined with a piece of cotton-insulated wire. Equipment was subsequently developed which would accommodate the grouping of the lines of a large number of subscribers in front of the operator. Inventive ingenuity had been so successful that by 1896 there were in use several switchboard exchanges accommodating from 5000 to 6000 subscribers.

With the development of these private exchanges, and the consequent engineering of private telephone systems designed to take care of the communication requirements of large commercial organizations, the way was opened for a more thorough study of systems especially suitable for police work.

It remained only to study the communication problems of the various police departments, large or small, in order to design a telephone communication system adequate for all ordinary needs. The telephone now rapidly began to replace the telegraph as the basic police communication facility. The police department of New York City, after a demonstration of the value of the telephone in police work at the time of the Columbian celebration in Chicago in 1892, installed a private switchboard and extensive telephone facilities in 1893. By 1903, "a remarkable proof of the enlarged scope given the [police] service by the use of the modern telephone exchange," in the words of the Census report, was "afforded by the latest development of the telephone police signal system recently put in operation in the city of New York." This system was determined upon early in 1903 after several conferences between Professor G. F. Sever, consulting electrical engineer of the city, and representatives of the New York Telephone Company. It was decided to install in the Borough of Manhattan 661 telephone stations, from 20 to 30 in each of the 29 police-patrol precincts. *After a careful investigation, it was decided to eliminate from this system all signal appliances apart from the telephone itself, as it was held that everything provided for in the ordinary combination signal and telephone box, and much more, could be done through the telephone station.*

A station consisted of a telephone transmitter and receiver and a call bell placed in a cast-iron box fastened to the side of a building. Six stations comprised one circuit. Each patrolman had a key and was required to report at a designated time each hour. If he was delayed more than fifteen minutes, a roundsman was sent out to investigate the cause of the delay. There was little chance of collusion, because the central operator could recognize the voices of all the men and could tell by the signal from what circuit the call was made. In each precinct station house a small switchboard was installed and the operator of this board took down and noted the reports of policemen, the time of the calls, and other details.

By 1905 the installation of the police-patrol telephone system was completed in Manhattan. It gave such general satisfaction that in September of that year the extension of the system to the eight precincts of the Bronx was approved. In the same year, it was recommended that the old signal system in Brooklyn, with its ancient telegraph equipment and iron wires strung on poles, be replaced by a telephone system, the report pointing out that to renew this system and place the wires underground would be enormously expensive and would take years;[8] but this recommendation was not carried out until later.

Since 1905, the use of telephones for both police and fire-alarm signaling has steadily increased. Because the Census figures do not separate the detailed data, it is impossible to discuss the police use of telephones apart from their use for fire-alarm purposes.[9] The data in the 1917 Census report, the latest available on this subject, showed 86,759 signaling boxes and 8094 telephone boxes used by the police and fire departments. The use of telephone boxes in both police and fire-alarm systems was increasing much more rapidly than that of signaling boxes, telephone boxes having increased 84.7 per cent between 1907 and 1917 and signaling boxes only 49.3 per cent in the same period. Telephone boxes, moreover, were used much oftener than were the signaling boxes. The 1902 Census report of municipal police and fire-alarm signaling systems, which contained more nearly complete data on the subject than any subsequent report, contained an analysis of the messages sent over the police systems. In that year, there were in police service 9476 signaling boxes, 1170 telephone boxes, and 1998 special telephones. Of the 40,626,505 police messages received and sent in that year, 23,393,812 were telephonic and 17,232,693 were signal-box messages and other kinds. "If . . . the number of special telephones be added to the number of telephoning boxes or stations," said the report, "it would ap-

[8] Police Department of the City of New York, *Annual Report,* 1905.

[9] Censuses of municipal electric fire-alarm and police-patrol signaling systems were published in 1907, 1912, and 1917.

pear that the 3,168 telephones are to be credited each with 7,384 calls sent or received, or about four times as many as the signaling boxes, a striking demonstration of the prominent part played by the telephone in the police patrol system."

The rapid replacement of the telegraph by the telephone as the fundamental police communicating medium is not surprising. The important question in police work, then as always, was how to make the police officer effective as a repressive or crime-preventing influence and, at the same time, to have him available for any emergencies that might arise. If the officer remained in precinct headquarters so as to be available in an emergency, his influence as a crime deterrent was lost. If he walked his beat as an ever-present threat to those who would trample on the rights of the ordinary citizen, he was almost useless in an emergency unless he happened by extreme coincidence to be at the scene of that emergency.

The introduction of the telephone was a significant step forward in solving this basic problem of police management. By means of the call box, the officer kept in touch with his headquarters regularly, and although it was impossible until after the development of recall systems for headquarters to get in touch instantly with officers in the field, the routine of reporting regularly established a definite connection at certain times between the officer and his superiors, who, in the interval between calls, might have learned of some occurrence which required his attention. Calling times were staggered, so that if the officer nearest was not available, other patrolmen, reporting from beats near by, could be sent.

Besides contributing toward the solution of this basic problem, the telephone offered the advantages of universal utility and extreme flexibility. In order to use the instrument, one needed only to know how to talk. When both police and public had access to telephone service, news of crime was learned quickly by a city's protector and, because of telephone service which permitted rapid connection with police officers near the scene of crime, the police were able to begin action with a minimum of delay. Without telephone service, criminal in-

vestigation was a slower procedure. Lack of communication facilities extended the escape time of the criminal and often important clues were erased before the police even had information that the crime had been committed.

INTRODUCTION OF THE POLICE RECALL SYSTEM

The need for a method by which headquarters could make known to the patrolman on the beat its desire to communicate with him was solved early in the twentieth century by the addition of visual and audible signals to the communication system. One of the first attempts in the country to employ a light signal for expediting patrol operations was made by Charles Foster, a private night watchman in Los Angeles, Calif. In 1905, Foster patrolled a section of West Adams Street on a bicycle, and was accompanied by a small fox terrier as his chief assistant. He soon found that some form of signaling device would add to the efficiency of his service and arranged with the (then) Home Telephone Company to install red lights on nine of its poles at different places in the area which he patrolled. As part of his plan, Foster instructed his employers to telephone his wife promptly concerning any crime or irregularity which should come to their attention. The light being wired directly to the Foster home, Mrs. Foster played the rôle of desk sergeant, and in an emergency signaled to her husband to call her for full particulars. Foster's efforts stand out as a significant event in the history of police communication, since they mark one of the first known applications to police service of the colored-light flashing system.

In various cities, semaphores and electric lights controlled from headquarters were placed on top of the police booths or on the lamp posts. When headquarters found it necessary to transmit a report or order to a particular patrolman, it could notify him by turning on the signal lights. As soon as the patrolman noticed the light, or heard the bell which was sometimes attached to the signal to make it even more noticeable, he called headquarters from the nearest police box and received his instructions. He could be informed quickly of

any matter on his beat requiring his attention, of all general alarms, and of such orders as headquarters might desire to give. The flexibility and coördination of the police department were enormously increased, for by the use of the recall system, headquarters at last had almost as effective control over the decentralized patrol force as it had over the men at the station house. The problem of how to make the policeman available in an emergency while serving as a crime deterrent on his beat was thus on the way to a definite solution.

The first calling signal used by modern police was a single-stroke bell in the signal box and was of value only while the patrolman was at the box. This was followed by a red-light installation, the light signal being mounted above the signal box and its operation being under the control of the operator at the central station. Such a signal is of value only when an officer is actually approaching the signal box. To overcome this deficiency, an audible signal was added, usually a bell. The audible range of the only type of bell available was limited, and this and the maintenance requirements demanded by its exposure to the weather were serious handicaps. The bell was finally replaced by a signal in which the sound was created when a diaphragm was struck rapidly by a vibrating hammer or by a motor-driven cam device. Such signals are known as horns, and the first-mentioned device has been found superior to the latter because it has a tone so distinctive that it cannot be confused with any other signal. Furthermore, it has no moving parts in which frictional resistance resulting from temperature changes or lack of proper lubricant can affect its operation, and the electrical energy required to operate it is reasonably low.

Improvements were soon made in recall-signal installations. The practice of placing the colored light on the patrol-box post proved unfortunate. The blinking signal was generally observed by the public before the patrolman noticed it, and consequently he usually found a large and expectant crowd gathered about the box when he approached it. This difficulty was solved by suspending the light over the center of street

intersections, which increased the visibility factor so far as the patrolman was concerned, did not interfere with traffic signals, and was not so conspicuous to the public.

In 1911, Police Chief E. A. Gravenor, of Camden, N. J., in an address at the annual convention of the International Association of Chiefs of Police, described with much enthusiasm the colored-light recall system which had recently been installed by his department. The lights were suspended from 22 to 25 feet above the surface of the street and were arranged in circuits of five or more lights, with a total of ten circuits for the entire city. With the control mechanism at headquarters, it was possible to switch on any combination of circuits from one to ten and burn them steadily or flash them according to a prearranged code.

Improvements in the type of electric globes and reflectors used in the signal equipment increased visibility both by day and by night and made possible the abandonment of the electric bells or horns which had proved disturbing to many citizens and a disadvantage to the police in many ways. New types of installation increased the applicability of the recall, permitting the summons of one particular patrolman, a group of patrolmen, or all officers on duty at the time. The recall system, moreover, instead of increasing the costs of the police department, actually decreased them.

New York City did not adopt the light-recall system until 1914. In 1911, the so-called fixed-post system was organized by the police commissioner in order to make a policeman quickly available to any citizen. Policemen were stationed in the middle of various street intersections where they could be noticed by anyone who might need their assistance. Other officers walked the beats, each beat starting and ending at a corner where there was a stationary officer. The officers would then alternate, one walking the beat and the other staying at the fixed corner post. This system of patrolling proved so expensive that in 1914 there was installed in the Twenty-third precinct an experimental flashlight recall system. The precinct was divided into recall zones, and the signal lamps were placed

on the patrol-box posts. A special feature of the New York system was the provision of "citizens' call buttons" attached to the signal boxes. Anyone needing a policeman could press a call button, which would cause the lamp to burn steadily and so notify the patrolman that he was needed. The recall system proved so efficient that by 1915 it had been extended to six precincts and its installation was planned in sixteen more. By 1919, the recall signals were in use in Brooklyn as well as in Manhattan. The growth and distribution of police recall systems has not been in proportion to their value to the service, but the accumulated evidence from many American communities which have installed them points to their increased use in the future.

MOTORIZATION AND RADIO COMMUNICATION

The development of wireless communication toward the end of the nineteenth century, together with the growing use of vehicles, gave opportunity for a complete change in police practice and technique. Half a century ago, not only did the policeman have no means of traversing his beat except on foot, but he was not even provided with any facilities for transporting to the station house the persons he arrested. The officer sometimes had literally to drag his prisoner to the station, and frequently the station was a mile or more from the point of arrest. If a prisoner was unruly, and they often were, it was a contest of muscular strength and physical endurance between the policeman and the person in custody.

Occasionally, if the prisoner was very stubborn or helplessly intoxicated, the policeman requisitioned a passing horse-drawn vehicle; and when required by duty to care for the sick and injured or to remove a dead body, his only recourse was an appeal to the owner of some suitable conveyance. Often, especially in the night and in stormy weather, "sick horse" was given as an excuse for refusing the officer's request. Prisoners were taken to the station house in wheelbarrows, push-carts, milk wagons, and other available conveyances. On one occasion a policeman stopped an empty hearse after a funeral

and, entering that gruesome vehicle with the prisoner, lay down on him and thus held him until a police station was reached.

Then came the horse-drawn patrol wagon,—variously known as the "Black Maria," "pie-wagon," and other as little-suited names,—another innovation in police service. The first of these patrol wagons were not very commodious, and they were uncovered, policeman and prisoners being in full view as they passed through the streets. Naturally they attracted attention and were followed by the usual crowd of curiosity seekers, but they were a great improvement upon muscular power, wheelbarrows, and milk wagons. With the appearance of the automobile as a means of transportation, officials charged with the management and control of police departments recognized its economic value in police work. At this writing, many departments are completely motorized and almost all of them possess one or more cars for emergency service.

The automobile as a universal means of rapid transportation, however, greatly complicated the problem of fighting the criminal. Modern improvements in automobile construction made it possible for an amazing number of persons to become qualified drivers. Present-day criminals, appreciating the enormous possibilities of motor transport for their purposes, have also found in the automobile, with its flexibility of service and speed, a much-desired means for rapid escape. To meet this situation the motor patrol was organized and has become one of the most important arms of law enforcement.

Until the radio reached its present development, there was no efficient means of keeping in touch with these cruising units of the department. The mobile policeman, like the foot patrolman, made periodic calls through the police boxes and so received his instructions—a procedure which of course reduced the efficiency and value of the new patrol units. The police therefore turned eagerly to radio as the medium which would solve this communication problem.

The possibilities of radio in police work were suggested, it

is said, as early as 1902, when two robbers escaping from Catalina Island, off the coast of California, were arrested, on reaching the mainland, by officers who had been notified by wireless. A more dramatic use of wireless in a criminal case was made in 1910 when a Mrs. Crippen disappeared. Her husband, Dr. Crippen, living in London, sent notes to friends indicating that she had died in California. Subsequently, a woman who had been the doctor's mistress began to live with him openly and to wear the wife's jewelry. The wife's friends reported the matter to Scotland Yard. An investigation, in which the doctor assisted, revealed nothing. Later, after the two had disappeared, sufficient evidence was produced for charges of murder against them, but they could not be found. On the steamship "Montrose," sailing from Holland to Quebec, the captain noticed the unusual caresses bestowed by a man passenger upon his supposed son, who proved to be a woman. The captain wirelessed the facts to Scotland Yard, two detectives took passage for Quebec, caught up with the "Montrose" off the Canadian shore, and returned to England with the prisoners. Dr. Crippen was hanged, the woman acquitted.

These isolated examples, however, only faintly foreshadowed the coming police usefulness of wireless communication. In 1908, upon the recommendation of the Police Commission of New York City, wireless telegraphy was provided between police headquarters and the police steamer "Patrol." The first regular police use of wireless was thus similar to its first commercial employment,—as a means of communication with vessels. Further development in the police use of wireless did not come until after the World War.

The first radio-station license issued for police service was granted on June 11, 1920, to the Department of Police, City of New York. The call signal was K-U-V-S. Almost simultaneously in various sections of the country, individual members of police departments, on their own initiative and encouraged by their chiefs, began to experiment with this new and promising instrumentality. Their apparatus was crude, but their

hopes were high. In the same year, Lieutenant-Colonel J. O. Mauburgne, now in charge of military communications on the Pacific Coast, assisted the Chicago police in the development of a transmitter and associated receiving apparatus. The late Inspector Mehrtens, of the police department of Berkeley, Calif., as early as 1921 foresaw the potentialities of police radio use and made extensive tests and observations with the coöperation of local broadcasting stations. With an automobile equipped with a receiving set, test cruises were made to various sections of the San Francisco Bay area. The experiments had varying success, the signal fading in and out at irregular intervals, but the persons present were convinced that final success only awaited the development of apparatus designed for the purpose.

In the same year, 1921, Captain Roy Scofield, of the police department of Toledo, Ohio, a captain in the Signal Corps and chief signal officer of the 37th Division during the World War, set up a transmitter at police headquarters and equipped his own automobile with a receiving set. Fading strength of the received signal and various forms of electrical interference handicapped operations so severely that the project was temporarily abandoned.

In 1920, prior to the experiments of Mehrtens and Scofield, Chief James Higgins, of Buffalo, N. Y., had read before the International Association of Chiefs of Police a paper entitled, "Use of Wireless Telegraph in Police Service." The paper presented the thesis that wireless was the solution to the problems of long-distance intercity police communication, and the author proposed a series of wireless stations for sending police information. Although the Chief made a good case for the need of a new method of sending long-distance police messages, he guessed incorrectly in respect to the medium to be employed for this purpose. Recent installations of long-distance teletypewriter networks appear to indicate this apparatus as the police long-distance communication medium, at least for the time being.

At the 1921 convention of the International Association,

Chief Higgins returned to the subject of radio and wireless in police work, stressing the application of radio to intracity communication. Significant experiments carried on by the Rochester, N. Y., police department in wireless communication between radio-equipped automobiles and police headquarters received special attention. A committee appointed to investigate the possibilities of radio in police work reported in 1924 an apparent consensus among chiefs of police that radio communication might prove very valuable in the future, but was still too little developed to be of great present value. The incomplete report submitted by the committee showed that the police of eleven cities had wireless receiving sets, five departments had their own broadcasting stations, and ten police departments (exclusive of those listed in the table on pp. 25–31) were making use of coöperating private receiving sets. In spite of the committee's pessimism, these data afforded a few crumbs of comfort to the radio enthusiasts among the police.

Apathy, inertia, even opposition, perennial enemies to innovation, had yet to be overcome by the advocates of police radio development. There were other quarters in which the approval of wireless was not quite unanimous. There were admirals and captains who were unalterably opposed to it; they believed that when a ship was out of sight of land she belonged in the hands of her master and that orders from the blue were an outrage and an affront to his dignity. A similar attitude prevailed, it is interesting to note, at the time of creation of the first police departments in this country, when great difficulty was experienced in both New York and Philadelphia in making the men wear uniforms. This form of dress was considered to be degrading to American manhood and the attempt to compel its use was resented. Indeed, it is said that in Philadelphia the uniform was not accepted as a part of the officer's equipment until 1860.

It is not surprising that openly expressed skepticism met the first proposals to experiment with radio apparatus as a device for police communication. To persons not versed in the

STATIONS OPERATING IN THE EMERGENCY SERVICE
MUNICIPAL POLICE STATIONS

Call letters	Licensee	Transmitter location	Frequency (kc.)	Power (watts)
KGZV	City of Aberdeen	Aberdeen, Wash.	2414	125
KADR	*City of Abilene	Abilene, Tex.	2458	50
KNHC	City of Ada	Ada, Okla.	2450	50
WPDO	City of Akron	Akron, O.	2458	100
WPGH	City of Albany	Albany, N. Y.	2414	300
KGZX	City of Albuquerque	Albuquerque, N. M.	2414	50
KACL	City of Altus	Altus, Okla.	2450	50
KARD	*City of Ardmore	Ardmore, Okla.	2450	50
WPED	Town of Arlington,	Arlington, Mass.	1712	100
WSAG	*City of Ashland	Ashland, Ky.	2430	200
KADQ	*City of Brea	Brea, Calif.	2490	50
WPFS	Buncombe County	Asheville, N. C.	2474	500
KACA	City of Atchison	Atchison, Kan.	2422	50
WPDY	City of Atlanta	Atlanta, Ga.	2414	400
WPDN	City of Auburn	Auburn, N. Y.	2382	50
WQFV	City Council of Augusta	Augusta, Ga.	2414	250
KGHU	City of Austin	Austin, Tex.	2442	100
KGPS	City of Bakersfield	Bakersfield, Calif.	2414	50
WPFH	Baltimore Police Dept.	Baltimore, Md.	2414	200
WBRP	*City of Baton Rouge	Baton Rouge, La.	2430	250
WPGA	City of Bay City	Bay City, Mich.	2466	50
KGPJ	City of Beaumont	Beaumont, Tex.	1712	100
KACK	City of Bellingham	Bellingham, Mass.	2414	50
WAKL	Belmont County	St. Clairsville, O.	2430	100
WPFK	Bergen County	Hackensack, N. J.	2430	500
KSW	City of Berkeley	Berkeley, Calif.	1658	500
KACM	City of Big Spring	Big Spring, Tex.	2458	50
WPGL	City of Binghamton	Binghamton, N. Y.	2442	400
WPFM	City of Birmingham	Birmingham, Ala.	2382	150
WAKH	Town of Bloomfield	Bloomfield, N. J.	2430	50
WBWV	*City of Bluefield	Bluefield, W. Va.	2490	50
WAMI	City of Bluffton	Bluffton, Ind.	2490	50
WPFW	City of Bridgeport	Bridgeport, Conn.	2466	50
WPHV	City of Bristol	Bristol, Va.	2450	50
WMPB	*City of Brockton	Brockton, Mass.	1712	50
KGHT	City of Brownsville	Brownsville, Tex.	2382	100
KNGW	City of Brownwood	Brownwood, Tex.	2458	200
WMJ	City of Buffalo	Buffalo, N. Y.	2422	500
WPHY	Carter County	Elizabethton, Tenn.	2474	100
KGOZ	City of Cedar Rapids	Cedar Rapids, Ia.	2466	50
KGHW	City of Centralia	Centralia, Wash.	2414	50
KGZF	City of Chanute	Chanute, Kan.	2450	25
WCPD	City Council of Charleston	Charleston, S. C.	2430	50
WPHI	City of Charleston	Charleston, W. Va.	2490	50
WPDV	City of Charlotte	Charlotte, N. C.	2458	500
KACJ	Chelan County	Wenatchee, Wash.	2414	250
WPDB	City of Chicago	Chicago, Ill.	1712	500

* Denotes construction permit only.

STATIONS OPERATING IN THE EMERGENCY SERVICE
MUNICIPAL POLICE STATIONS—*Continued*

Call letters	Licensee	Transmitter location	Frequency (kc.)	Power (watts)
WPDC	City of Chicago	Chicago, Ill.	1712	500
WPDD	City of Chicago	Chicago, Ill.	1712	500
KACF	City of Chickasha and Grady County	Chickasha, Okla.	2450	50
WKDU	City of Cincinnati	Cincinnati, O.	1706	500
WPFP	City of Clarksburg	Clarksburg, W. Va.	2490	30
KNGE	City of Cleburne	Cleburne, Tex.	1712	50
WRBH	City of Cleveland	Cleveland, O.	2458	500
KAPE	County of Cleveland	Norman, Okla.	2450	100
KNFA	City of Clovis	Clovis, N. M.	2414	50
KGZP	City of Coffeyville	Coffeyville, Kan.	2450	50
WPGU	Town of Cohasset	Cohasset, Mass.	1712	50
WPFI	City of Columbus	Columbus, Ga.	2414	50
KNFM	City of Compton	Compton, Calif.	2490	25
WAMB	City of Connersville	Connersville, Ind.	2442	40
KGHV	City of Corpus Christi	Corpus Christi, Tex.	2382	50
WPGK	City of Cranston	Cranston, R. I.	2466	50
KAPB	City of Cushing	Cushing, Okla.	2450	50
KVP	City of Dallas	Dallas, Tex.	1712	500
KVPA	City of Dallas	Dallas, Tex.	1712	500
KGPN	City of Davenport	Davenport, Ia.	2466	100
WPDM	City of Dayton	Dayton, O.	2430	150 250†
KNHF	City of Denton	Denton, Tex.	1712	100
KGPX	City and County of Denver	Denver, Colo.	2442	150
KGZG	City of Des Moines	Des Moines, Ia.	2466	100
WCK	Detroit Police Dept.	Detroit, Mich.	2414	500
WPDX	Detroit Police Dept.	Detroit, Mich.	2414	500
KNGH	City of Dodge City	Dodge City, Kan.	2474	50
KNFE	City of Duluth	Duluth, Minn.	2382	400
KNGK	City of Duncan	Duncan, Okla.	2450	50
WPEI	East Providence Police Dept.	East Providence, R. I.	1712	50
KNGJ	City of El Centro	El Centro, Calif.	2490	100
KAPD	City of Eldorado	Eldorado, Kan.	2450	50
KGZM	City of El Paso	El Paso, Tex.	2414	100
WASF	*Elwood Police Dept.	Elwood, Ind.	2442	50
KAPK	*City of Enid	Enid, Okla.	2450	50
KADV	City of Eugene	Eugene, Ore.	2442	50
WAKF	City of Everett	Everett, Mass.	1712	50
KNFP	City of Everett	Everett, Wash.	2414	50
WPHJ	City of Fairmont	Fairmont, W. Va.	2490	100
WAKV	City of Fall River	Fall River, Mass.	1712	50
KNHM	City of Fargo	Fargo, N. D.	2442	100
WPHA	City of Fitchburg	Fitchburg, Mass.	2466	50
WPDF	City of Flint	Flint, Mich.	2466	150

* Denotes construction permit only.

† Denotes construction permit for increase in power.

STATIONS OPERATING IN THE EMERGENCY SERVICE
MUNICIPAL POLICE STATIONS—*Continued*

Call letters	Licensee	Transmitter location	Frequency (kc.)	Power (watts)
WAKO	City of Fort Lauderdale..	Fort Lauderdale, Fla..	2442	50
KNHE	City of Fort Smith.....	Fort Smith, Ark.....	2406	100
WPDZ	City of Fort Wayne.....	Fort Wayne, Ind.....	2490	200
WAKK	City of Frankfort.....	Frankfort, Ind.....	2490	50
WPDI	Franklin County Board of Commissioners	Columbus, O.....	2430	200
KGZA	City of Fresno.....	Fresno, Calif.....	2414	500
WQFC	City of Gainesville.....	Gainesville, Fla.....	2466	50
KADM	City of Gainesville.....	Gainesville, Tex.....	1712	50
KRPW	City of Galveston.....	Galveston, Tex.....	1712	50
KNFH	City of Garden City.....	Garden City, Kan.....	2474	50
WPEB	City of Grand Rapids.....	Grand Rapids, Mich...	2442	500
KNHB	City of Green Bay.....	Green Bay, Wis.....	2382	100
WMPG	*City of Greenville.....	Greenville, Miss.....	2490	50
KACU	Gregg County Sheriff's Dept.....	Longview, Tex.....	1712	250
WRDR	Township of Grosse Pointe	Lochmoor, Mich.....	2414	50
KADK	*County of Hawaii.....	Hilo, T. H.....	2450	100
WAKN	Village of Herkimer.....	Herkimer, N. Y.....	2414	50
WMO	City of Highland Park....	Highland Park, Mich..	2414	50
KGPQ	City and County of Honolulu.....	Honolulu, T. H.....	1712	100
KAPL	City of Hoquiam.....	Hoquiam, Wash.....	2414	50
KHTP	City of Houston.....	Houston, Tex.....	1712	200
WAKA	City of Huntington.....	Huntington, Ind.....	2490	50
WPGO	Town of Huntington.....	Huntington, N. Y.....	2490	25
KVPB	City of Huron.....	Huron, S. D.....	2450	40
KGHN	City of Hutchinson.....	Hutchinson, Kan.....	2450	50
KNFB	City of Idaho Falls.....	Idaho Falls, Ida.....	2458	500
WMDZ	City of Indianapolis.....	Indianapolis, Ind.....	2442	400
KAPG	City of Iola.....	Iola, Kan.....	2450	50
WPHP	City of Jackson.....	Jackson, Mich.....	2466	50
WAMK	City of Jackson.....	Jackson, Miss.....	2490	50
WPFG	City of Jacksonville.....	Jacksonville, Fla.....	2442	400
WPGZ	City of Johnson City.....	Johnson City, Tenn....	2474	50
WAMG	City of Kalamazoo.....	Kalamazoo, Mich.....	2442	100
KGPE	City of Kansas City.....	Kansas City, Mo.....	2422	500
WPEP	County and City of Kenosha.....	Kenosha, Wis.....	2450	100
KACS	Kern County.....	Bakersfield, Calif.....	2414	500
KADL	Kitsap County Sheriff's Office.....	Port Orchard, Wash....	2414	50
KGZH	City of Klamath Falls....	Klamath Falls, Ore....	2442	25
WPFO	City of Knoxville.....	Knox County, Tenn...	2474	400
WPDT	City of Kokomo.....	Kokomo, Ind.....	2490	50
WQFQ	City of Lafayette.....	Lafayette, Ind.....	2442	50
WQFX	Lake County.....	Waukegan, Ill.....	1712	100
WPFT	City of Lakeland.....	Lakeland, Fla.....	2442	50

* Denotes construction permit only.

STATIONS OPERATING IN THE EMERGENCY SERVICE
MUNICIPAL POLICE STATIONS—*Continued*

Call letters	Licensee	Transmitter location	Frequency (kc.)	Power (watts)
WQFO	City of Lancaster	Lancaster, O.	2430	50
WPDL	City of Lansing	Lansing, Mich.	2442	50
WQFZ	County of Lasalle	Ottawa, Ill.	2458	500
KGHG	City of Las Vegas	Las Vegas, Nev.	2474	50
KGHP	City of Lawton	Lawton, Okla.	2450	50
KNFF	City of Leavenworth	Leavenworth, Kan.	2422	50
WPET	City of Lexington	Lexington, Ky.	1706	500
KGZU	City of Lincoln	Lincoln, Neb.	2490	200
KGHZ	City of Little Rock	Little Rock, Ark.	2406	100
KNGY	City of Lodi	Lodi, Calif.	2414	40
WAMN	City of Lorain	Lorain, O.	2458	50
KGPL	City of Los Angeles	Los Angeles, Calif.	1712	500
KNGX	City of Los Angeles	Portable	1712	200
WPDE	City of Louisville	Louisville, Ky.	2442	200
KGZW	City of Lubbock	Lubbock, Tex.	2458	250
WQFH	City of Lynchburg	Lynchburg, Va.	2450	50
WQFB	City of Macon	Macon, Ga.	2414	50 250†
WASB	*Macon County, Sheriff's Dept.	Decatur, Ill.	2458	100
WASD	*City of Madison	Madison, Wis.	2382	250
KADH	*City of Mangum	Mangum, Okla.	2450	50
WQFY	City of Mansfield	Mansfield, O.	2474	50
KADT	City of Marshall	Marshall, Tex.	1712	50
KADS	*City of Marysville	Marysville, Calif.	2422	50
KADE	*City of McPherson	McPherson, Kan.	2450	50
WPHG	City of Medford	Medford, Mass.	1712	50
WPEC	City of Memphis	Memphis, Tenn.	2466	400
WPFZ	City of Miami	Miami, Fla.	2442	500
WAKW	City of Miami	Portable	2442	40
WPDK	City of Milwaukee	Milwaukee, Wis.	2450	500
KGPB	City of Minneapolis	Minneapolis, Minn.	2430	400
KGPR	City of Minneapolis	Minneapolis, Minn.	2430	400
WPGW	City of Mobile	Mobile, Ala.	2382	400
WQFF	City of Monessen	Monessen, Pa.	2482	50
WAKC	Board of Chosen Freeholders, County of Monmouth, N. J.	Freehold, N. J.	2366	100
WPGP	City of Muncie	Muncie, Ind.	2442	100
WPFC	City of Muskegon	Muskegon, Mich.	2442	50
KNGT	City of Muskogee	Muskogee, Okla.	2450	50
WPHB	City of Nashua	Nashua, N. H.	2422	50
WPGS	County of Nassau	Mineola, N. Y.	2490	400
WANG	County of Nassau, N. Y.	Portable-mobile	2490	10
WAMJ	City of Natchez	Natchez, Miss.	2490	50
WMPN	*Town of Needham	Needham, Mass.	1712	50

* Denotes construction permit only.
† Denotes construction permit for increase in power.

STATIONS OPERATING IN THE EMERGENCY SERVICE
MUNICIPAL POLICE STATIONS—*Continued*

Call letters	Licensee	Transmitter location	Frequency (kc.)	Power (watts)
WPFN	City of New Bedford	Fairhaven, Mass.	1712	100
WPGT	City of New Castle	New Castle, Pa.	2482	50
WQFA	City of New Haven	New Haven, Conn.	2466	100
WAKB	City of New London	New London, Conn.	2466	100
WPEK	City of New Orleans	New Orleans, La.	2430	250
WPFA	City of Newton	Newton, Mass.	1712	50
WPEE	City of New York	Brooklyn, N. Y.	2450	400
WPEF	City of New York	New York, N. Y.	2450	400
WPEG	City of New York	New York, N. Y.	2450	500
WNFP	City of Niagara Falls	Niagara Falls, N. Y.	2422	125
KNGN	City of Norfolk	Norfolk, Neb.	2490	25
WQFL	Village of Oak Park	Oak Park, Ill.	1712	50
KADI	City of Oceanside	Oceanside, Calif.	2490	37.5
WPHZ	City of Oil City	Oil City, Pa.	2482	50
KGPH	County of Oklahoma	Oklahoma City, Okla.	2450	250
KACT	County of Oklahoma, Okla.	Portable-mobile	2450	20
KNGO	County of Oklahoma, Okla.	Portable-mobile	2450	50
KAPF	City of Okmulgee	Okmulgee, Okla.	2450	50
KACE	City of Olympia	Olympia, Wash.	2414	50
KGPI	City of Omaha	Omaha, Neb.	2466	400
WQFJ	City of Oneonta	Oneonta, N. Y.	2414	50
KGHX	County of Orange	Santa Ana, Calif.	2490	400
WPHM	City of Orlando	Orlando, Fla.	2442	50 500†
WPFX	Town of Palm Beach	Palm Beach, Fla.	2442	50
KGHK	City of Palo Alto	Palo Alto, Calif.	1674	20
WPHQ	City of Parkersburg	Parkersburg, W. Va.	2490	50
KGJX	City of Pasadena	Pasadena, Calif.	1712	400
WPFV	City of Pawtucket	Pawtucket, R. I.	2466	50
WASC	*City of Peru	Peru, Ind.	2490	50
WQFI	City of Petersburg	Petersburg, Va.	2450	250
WPDP	City of Philadelphia	Philadelphia, Pa.	2474	500
KGZJ	City of Phoenix	Phoenix, Ariz.	2430	100
WAKG	Pinellas County	Clearwater, Fla.	2466	250
WPDU	City of Pittsburgh	Pittsburgh, Pa.	1712	400
KNFJ	City of Pomona	Pomona, Calif.	1712	50
KACP	City of Ponca City	Ponca City, Okla.	2450	50
WPGB	City of Port Huron	Port Huron, Mich.	2466	50
WPFU	City of Portland	Portland, Me.	2422	100
KGPP	City of Portland	Portland, Ore.	2442	500
WPGI	City of Portsmouth	Portsmouth, O.	2430	100
KNHG	City of Prescott	Prescott, Ariz.	2430	10
WPGF	City of Providence	Providence, R. I.	1712	150
KNGM	City of Rapid City	Rapid City, S. D.	2450	50
WPFE	City of Reading	Reading, Pa.	2442	100

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† Denotes construction permit for increase in power.

STATIONS OPERATING IN THE EMERGENCY SERVICE
MUNICIPAL POLICE STATIONS—*Continued*

Call letters	Licensee	Transmitter location	Frequency (kc.)	Power (watts)
KGHM	City of Reno	Reno, Nev.	2474	50
WPDH	City of Richmond	Richmond, Ind.	2442	50
WPHF	City of Richmond	Richmond, Va.	2450	400
WQFG	City of Roanoke	Roanoke, Va.	2450	100
WPDR	City of Rochester	Rochester, N. Y.	2422	200
WPGD	City of Rockford	Rockford, Ill.	2458	50
KNGF	City of Sacramento	Sacramento, Calif.	2422	400
WPES	City of Saginaw	Saginaw, Mich.	2442	100 500†
KGPC	City of St. Louis	St. Louis, Mo.	1706	500
WPDS	City of St. Paul	St. Paul, Minn.	2430	500
KGZR	City of Salem	Salem, Ore.	2442	50
KNGV	City of Salina	Salina, Kan.	2422	50
KGPW	Salt Lake City, a Municipal Corporation	Salt Lake City, Utah	2406	100
KSBC	San Bernardino County Radio	San Bernardino, Calif.	1712	500
KACN	City of San Buenaventura	San Buenaventura, Calif.	2414	50
KGZD	City of San Diego	San Diego, Calif.	2490	500
WAKI	City of Sandusky	Sandusky, O.	2474	50
KGPD	City and County of San Francisco	San Francisco, Calif.	2466	400
KAPH	County of San Joaquin	Stockton, Calif.	2414	500
KGPM	City of San Jose	San Jose, Calif.	2466	100
KGZO	City of Santa Barbara	Santa Barbara, Calif.	2414	100
KGZT	City of Santa Cruz	Santa Cruz, Calif.	1674	100
KGPF	City of Santa Fe	Santa Fe, N. M.	2414	25
KGPA	Seattle Police Dept.	Seattle, Wash.	2414	500
KACR	City of Seminole	Seminole, Okla.	2450	50
WQFU	City of Sharon	Sharon, Pa.	2482	50
KWCM	*City of Shawnee	Shawnee, Okla.	2450	100
WAMH	*Shelby Police Dept.	Shelby, O.	2474	25
KNGP	City of Shreveport	Shreveport, La.	2430	100
KGPK	City of Sioux City	Sioux City, Ia.	2466	100
KNFI	Skagit County	Mt. Vernon, Wash.	2414	50
WPEH	City of Somerville	Somerville, Mass.	1712	100
WPGN	City of South Bend	South Bend, Ind.	2490	100
KGHS	City of Spokane	Spokane, Wash.	2414	100
WPHD	City of Steubenville	Steubenville, O.	2458	100
WPFQ	Borough of Swarthmore	Swarthmore, Pa.	2474	50
KAPJ	*City of Sweetwater	Sweetwater, Tex.	2458	40
WPEA	City of Syracuse	Syracuse, N. Y.	2382	400
KGZN	City of Tacoma	Tacoma, Wash.	2414	100
WPHN	City of Tampa	Tampa, Fla.	2466	100
WRDQ	City of Toledo	Toledo, O.	2474	400
KGZC	City of Topeka	Topeka, Kan.	2422	50

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† Denotes construction permit for increase in power.

STATIONS OPERATING IN THE EMERGENCY SERVICE

MUNICIPAL POLICE STATIONS—*Concluded*

Call letters	Licensee	Transmitter location	Frequency (kc.)	Power (watts)
KACO	City of Tracy	Tracy, Calif.	2414	16.5
WPDA	City of Tulare	Tulare, Calif.	2414	150
KGPO	City of Tulsa	Tulsa, Okla.	2450	100
KADG	City of Tulsa, Okla.	Mobile	2450	10
WAGR	City of Urbana	Urbana, Ill.	2458	40
WPGJ	City of Utica	Utica, N. Y.	2414	100
KGPG	City of Vallejo	Vallejo, Calif.	2422	50
KGZQ	City of Waco	Waco, Tex.	1712	50
KACV	City of Walla Walla	Walla Walla, Wash.	2414	50
WPIA	Town of Warren	Warren, R. I.	1712	40
WPDW	District of Columbia Metropolitan Police	Washington, D. C.	2422	400
WMPW	*City of Waterbury	Waterbury, Conn.	2466	50
WMPD	*County of Waukesha	Waukesha, Wis.	2450	100
KGHY	City of Whittier	Whittier, Calif.	1712	50
KGPZ	City of Wichita	Wichita, Kan.	2450	250
KGZI	City of Wichita Falls	Wichita Falls, Tex.	2458	200
WQFM	City of Wilkes-Barre	Wilkes-Barre, Pa.	2442	100
WAKE	Winnebago County	Oshkosh, Wis.	2382	100 400†
WPEM	City of Woonsocket	Woonsocket, R. I.	2470	50
WPGX	City of Worcester	Worcester, Mass.	2466	100
KNGU	City of Yakima	Yakima, Wash.	2414	100
WPFY	City of Yonkers	Yonkers, N. Y.	2442	400
WAKX	City of York	York, Pa.	2442	40
WPDG	City of Youngstown	Youngstown, O.	2458	250
KADF	Yuma County	Yuma, Ariz.	2490	50
WPHO	City of Zanesville	Zanesville, O.	2430	50

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† Denotes construction permit for increase in power.

technique of radio, it seemed a complicated and even impossible undertaking, but to those who understood this modern instrument of communication it was a smooth-running machine of great potential usefulness in the suppression of crime and the upholding of law and order. Its adoption by the police was slow, for wireless apparatus easily appeared too complicated for the layman to understand. The police in many cities concealed their ignorance of the subject by sweeping announcements that the expense involved would not be justified by the results. As late as March, 1927, the following editorial appeared in a prominent American police publication.

RADIO NOT FOR POLICE

One of the bright prospects which appears to have become a disappointment is that of the use of radio as an auxiliary to police work. Yet it is not certain that the failure is a permanent one and the lack of results up to this time may prompt some genius to bring out an idea which will turn a failure into success.... Despite some very valuable instances of crime apprehension through radio alarms, the fact remains that the more profitable use of the radio is still a standing police problem.

Oral expressions of skepticism were more to the point. The police commissioner in one of the largest cities in the United States, as late as 1931, vehemently opposed the adoption of a police radio system by that department. The city council was ready and anxious to appropriate funds for the installation, the public and the press openly condemned his stubborn opposition; yet he persistently decried the use of what he termed "new-fangled contrivances." His attitude was disregarded, however, and the city concerned now possesses one of the most up-to-date radio patrol systems in the United States.

In their earliest efforts in the radio field, police departments made use of commercial broadcasting stations, as in the experiments conducted by the New York Police Department in 1924. Even earlier, before the days of popular broadcasting, under the first police radio license granted in this country the New York Police Department maintained and operated a telegraph transmitting station, transmitting in telegraphic code information on stolen cars or missing persons. These messages were picked up by amateurs, wireless operators on incoming vessels, and other persons who understood the code.

In general, however, in the first attempts to use radio broadcasting in police work, information was sent out over a commercial station or over some station operating in the entertainment frequency bands. The attendant disadvantages were obvious. Information about the activities of the police was received not only by police stations equipped with receivers, but also by radio listeners everywhere within range of the station.

There were more far-reaching disadvantages. The personnel of commercial broadcasting stations were unfamiliar with police practice and technique and were therefore incapable in handling police traffic effectively. Broadcasting organizations, moreover, exist primarily for entertainment purposes and it was not feasible to "break in" at any point on a program for a police broadcast. The time-interval delay in finally putting the police call on the air was often so long as to defeat its purpose. Furthermore, a certain amount of secrecy is indispensable to the success of police operations. The use of a broadcasting station often involved the release to the public of information essentially confidential. It should be said, however, that the owners of many commercial broadcasting stations displayed a gratifying spirit of coöperation in putting their facilities at the disposal of the police when need arose. For the reasons mentioned, the police have found it necessary to develop and install their own transmitting equipment, but commercial broadcasting stations still hold great promise for police use in the locating of missing persons and under disaster conditions when the usual means of communication are paralyzed. These matters are considered in some detail in another chapter.

In the beginning, Canadian authorities also seized upon the apparent opportunity presented by the already established broadcasting stations. As in the United States, this was a logical preliminary step in police broadcasting because, with a modern station already in existence, the only police expense involved was the cost of receiving equipment for the selected police stations. In Edmonton, Alberta, through the courtesy of C-J-C-A, a broadcasting station operated by the Edmonton *Journal,* information was broadcast twice daily relative to stolen automobiles, and lost children and other missing persons. Scotland Yard made a similar arrangement with the British Broadcasting Corporation.

The years 1926 to 1928 represent a significant period in the history of police radio communication. Almost simultaneously in this interval, the police in various parts of the United

States began to experiment with whatever apparatus was available. Transmitters constructed of spare parts and assembled with the assistance of local radio amateurs were installed on police stations and, with receivers of like pedigree mounted in police cars, the first police radio systems began to assume their present form. Although these tests were uniformly successful, they were everywhere attended with numerous difficulties, the same in every place where such experiments were conducted.

The operation of a radio receiver in a moving automobile presented an entirely original problem. Little or no technical material had been written or published on this phase of radio reception, and progress was in large part a process of trial and error. Road shock, constant change of position, interference originating in the electrical circuits of the car and from outside sources, fading of signal, and other problems arose at once for solution. During this period the police were greatly indebted to the zealous band of operators in the field of amateur radio. It was the amateur who discovered the true value of short waves and found that he could chat round the world by means of very simple apparatus which consumed less current than an electric flat iron or toaster. In a dozen or more cities and communities, these youngsters, with no small amount of engineering knowledge gained from study and actual construction of radio transmitters and receivers, stepped in and without compensation gave of their time and energy to the development of police radio equipment. Their invaluable assistance to officers in the various departments who pioneered in the radio project holds an important position in the history of police radio communication.

Police departments in a number of cities, notably Detroit, Mich., and Berkeley, Calif., were moving ahead steadily with experimental installations and continuous tests. Detroit began using radio in police work in 1921, just after the beginning of commercial broadcasting. The results were not satisfactory and in the spring of 1927 the station was closed. In the fall of that year, Commissioner Rutledge placed a former

traffic patrolman, Kenneth R. Cox, in charge of radio development in Detroit. Assigned with him were Walter Vogler and Bernard Fitzgerald, both experienced radio men. Cox, a former engineering student of Purdue University, reopened the station in April, 1928, and the results obtained from that day to the present have played an influential part in the permanent establishment of radio as a police instrument. The system developed in Detroit of broadcasting, over a short-range station, information to cruising police cars equipped with radio receivers attuned to that station alone, is, in essence the system universally adopted.

The present author, with the assistance of a young engineering student, Reginald Tibbetts, in 1926 established what was probably the first radio contact on the Pacific Coast between police headquarters and a moving patrol car. In that year, following a study of the apparatus then available, a 50-watt Hartley-type transmitter was built and installed at police headquarters at Berkeley, Calif., by members of the department, and experiments were conducted with a police car equipped for radio reception. These experiments terminated in 1928 with the installation of a 75-watt transmitter employing the Hartley circuit and the construction of a 7-tube automobile receiver especially designed for this type of service. The increased power of the transmitter proved a valuable aid. The new receiver, consisting of three stages of screen-grid radio frequency, a detector, and three stages of audio amplification, although somewhat elaborate, performed admirably under actual operating conditions in a police car. With this equipment it became possible to demonstrate officially that the system was entirely feasible and that the time was opportune for the installation of standard radio equipment at police headquarters.

From its inception the project enjoyed the interest and support of municipal officials, and in the year following these experiments funds were appropriated and professional radio engineers were consulted for the design and construction of a modern radio-communication system. This installation was

unique in that it was designed for code transmission exclusively and used primarily as a fast signaling system. Coded calls were assigned to radio patrol officers, and code combinations covering street intersections, crime classifications, and personal descriptions were prepared, to increase further the usefulness of the apparatus. The average time required to make contact with patrol cars was 45 seconds, day or night, and under any and all weather conditions. The transmitting equipment was automatic in operation.

Meanwhile, Canadian police officials were alert to the possibilities of rapid communication: the recognition and growth of radio as a facility for police communication was not confined to this country. The men engaged in the battle against crime in Canada had no illusions about the seriousness of the situation. In an address given before the Chief Constables' Association of Canada, in 1926, Inspector T. W. A. Parsons, of the British Columbia Provincial Police, declared that the most effective means of defeating speedy transportation as a weapon of the criminal was by accelerated intercommunication as a weapon of the police. With this end in view, the British Columbia police decided to experiment with radiotelephony and radio-telegraphy. Subsequently, a police radio network was constructed with 50-watt transmitters installed in the divisional offices at Vancouver, Prince Rupert, Kamloops, Nelson, and Victoria. Each station could communicate with all the others, either individually or collectively, and an immediate reply could be received to any message transmitted. This installation was designed for code communication and provided a system which effectively blanketed the entire province.[10]

Further, the board of police commissioners of the city of Winnipeg, Manitoba, on May 23, 1930, awarded a contract to the Canadian Marconi Company for the construction of a modern police radio station. The Winnipeg system, the first

[10] According to recent information, the Alberta Provincial Police were amalgamated with the Royal Canadian Mounted Police on April 1, 1932, and shortly thereafter the use of the radio system was discontinued.

radio-telephone transmitter in Canada to be used exclusively in the suppression and prevention of crime, is a model station and equal to any in the United States.

The value of speed of communication in the apprehension of criminals was becoming increasingly recognized by police authorities throughout the world and the police radio stations for police operations exclusively grew in number by leaps and bounds.[11] Toward the end of 1929, radio construction permits, covering the installation of radio equipment necessary for communication between police headquarters and motor patrols or squad cars, had been granted to twenty police departments in the United States by the Federal Communications Commissions at Washington, D. C.

The development of police radio systems directly parallels that of automobile reception. Satisfactory transmitters were available long before automobile receivers became practical. It was not until 1930 that commercial manufacturers of standard receiving equipment entered the field of automobile radio. The first sets to appear on the market, although a decided improvement on all previous attempts, were not entirely satisfactory. It was clear, however, that there was a definite, popular market for this type of equipment, and engineers concentrated upon the development of improved receivers, principally through reorganization of circuit design. The introduction of the "B eliminator" and other current-supply devices, as well as exceptional improvement in tube design and construction, soon resulted in an automobile receiving set which rivaled the performance of the standard home receiver. With efficient receiving apparatus available, police radio communication took another big stride forward and by 1933 the number of systems in operation had expanded from tweny-six to almost one hundred. Licensed state police stations were in operation in the states of Iowa, Louisiana, Massachusetts, Michigan, Pennsylvania, and Texas, and Massachusetts had on file applications for four additional state police radio stations, including one portable station. In many

[11] See Chapter XIII, "Foreign Police Communication Systems" (p. 404).

communities, moreover, the police radio served the fire department also, and in four cities—Boston, Detroit, San Francisco, and Seattle—the fire departments had their own radio stations.

This unexpected expansion of the new means of patrol communication was accompanied by even more astounding performance. So spectacular have been the achievements of radio in the police field that one is tempted to abandon plain statement of fact and describe them in the language of the sensational press. Only a few typical examples, taken from actual police records, are given here.

Two officers waiting in a radio patrol car for the "Go" signal received a broadcast from Chicago police headquarters describing two men in an automobile who were wanted for bank robbery and murder, committed a few minutes before. While the officers were listening, a car with two men in it stopped alongside to await the traffic signal and the officers had only to step from one car to another to make an important arrest. Contrast this with the period when policemen were walking beats and reporting in at one-hour intervals. Frequently, those farthest from a disturbance received the information first and hurried to the scene, their necessary use of their sirens giving ample warning to the fugitive that the police were on the way. Now, the radio-patrol officers nearest the scene are informed, and frequently they are within a block or two of the disturbance.

The clerk of a hotel in Hollywood was held up, robbed, kidnaped, and thrown from the bandits' car some distance from the hotel. From his telephoned description, the police complaint board identified the car's license number as that of a car stolen just prior to the robbery. This information was given to all police radio patrol cars, and the two bandits were captured some ten miles from the hotel, eighteen minutes after the broadcast.

The Radio Police Division of Los Angeles arrested in May, 1933, the first month of its radio operation, 66 more suspects than the entire force had seized in the preceding month. In

April, uniformed men had made 559 arrests, of which 41 were for felonies; in May, the officers manning the 43 police-radio cars made 625 arrests, of which 178 were for major crimes. In April, 177 robberies were reported; in May, with radio-equipped cars cruising the streets day and night, the number of robberies reported dropped to 133.

On May 29, 1933, the manager of a branch bank in Los Angeles was held up by three men. The manager, in his report to the police department, gave the two license numbers on the car, one on the front and one on the rear. The car was traced through the registration of licenses at the Motor Vehicle Department and found in the garage at one of the registered addresses. Two officers guarded the premises while the third phoned to headquarters and received instructions to await reënforcements. Three radio patrol cars made the run in less than three minutes and the three robbers were captured. The robbers had intended to resist the two officers, but upon the prompt arrival of the other six they decided that their situation was hopeless. The case was entirely cleared up within thirty-five minutes after the robbery; yet when the officers arrived the money had been divided and the men were just about to separate.

Numerous instances might be cited of arrests made by police radio patrols within from ten to sixty seconds for such offenses as breaking and entering, robbery, and extortion. Only one further example, however, of the great value of the radio patrol will be given, taken from the records of the Detroit Police Department; a case which, without the assistance of radio-equipped automobiles, would have been added to the long list of police mysteries, possibly to remain there.

Three men directed a taxicab driver to take them from Detroit to the suburb of Ferndale. In a sparsely settled section, the driver was bound and tied to a tree, and the three drove away in the cab. It was more than thirty minutes before the driver was able to report to the Detroit police, but thirty seconds afterward the alarm was broadcast to cruising cars. The cab was sighted, a gun fight followed, and in only a few

minutes after the broadcast two of the men were in custody, one of them with $5000 in his pocket. The third escaped. The case, however, was only begun, as eventually these arrests led to the discovery that the $5000 was ransom money paid in a kidnaping as yet unknown to the police. The arrests made were most important, for the men confessed to a long series of major crimes. Both had served terms in the Michigan state prison, and they were wanted in two other states for parole violations.

The foregoing illustrations of the effectiveness of the police radio patrol might be multiplied almost indefinitely. They have a significance that the casual reader may not appreciate, for they hold the promise that society has in its hands a powerful agency of social control. And the adaptation of radio to police operations has barely begun : constant experimentation is going on in police departments the world over. In London, Scotland Yard not only employs the radio-equipped cruiser, but also makes use of vans equipped with both receiving and transmitting apparatus, thus establishing two-way communication between the mobile patrol and police headquarters. The possibilities of this new development stagger the imagination. It is receiving the serious attention of many police departments in the United States, and several cities have already added this two-way communication to their police equipment. In a number of police departments, also, radio receiving apparatus has been successfully installed on solo motorcycles, as well as on those provided with side-car equipment, making these mobile units a more effective force in traffic and patrol operations.

State governments are recognizing the growing usefulness of radio communication in police work. In 1929, Michigan provided by law for a state owned and operated police radio station. All state police cars were equipped with radio equipment, and receiving sets were installed in sheriffs' and police chiefs' offices throughout the state. As already indicated, a number of state police radio stations are now licensed and in active operation.

The need for police coördination, the problems of radio interference, and the dictates of economy have brought about the creation of regional police radio systems in several of the metropolitan areas of the United States. The Chicago police department was the first to offer radio service to other communities in the metropolitan area, and at the present time the three Chicago police transmitters serve fifty-six other police jurisdictions, covering three counties with a combined area of 1328 square miles and a population of more than 4,000,000. At this writing there are thirty-five regional radio systems serving areas ranging from 15 square miles in Kansas City to 1446 square miles in the East Bay area surrounding Berkeley, Calif., and used by about 300 police organizations.

The police use of radio has received recognition from both national and international authorities charged with the regulation of radio. The International Radio Conferences have set aside certain wave lengths for the exclusive use of police forces in international communication. In the United States, the Federal Communications Commission, with commendable foresight, issued an order in April, 1930, setting aside five additional wave lengths for police purposes exclusively and regulated the power of the individual stations on the basis of population in the area served. Influenced, no doubt, by the International Association of Chiefs of Police, this Commission has taken steps to have the problem of police frequency and power assignments expertly studied and it is to be expected that the future will provide ample freedom for the full development of this important arm of law enforcement.

ORIGIN OF BURGLAR- AND HOLDUP-ALARM SYSTEMS

The following brief account is a history of the need for alarm-system protection rather than a history of the alarm systems themselves. Chroniclers of past times have had little or nothing to say on the subject and it must be assumed that burglary and robbery protection has been, in former times as it is today, one of the most neglected fields of police communication and practice.

In the early years of the nineteenth century, the only known device for fastening a door was some form of the key-operated lock. The possible variations of locks were few and the mechanism quite simple. Adroit burglars of the period were intimately familiar with all of them and needed but a glance at the door to select the required key.

History does not inform us how strong-box burglars operated before the days of Jack Shepard, who was executed in London in 1724. The crude burglar tools of his time, however, remained in use generally until gunpowder came into play for "blowing" safes. About 1868, a maker of machine tools suggested to the inquiring mind of a burglar, George White, alias George Miles, the wedge to force open the doors of the new burglar-proof safes which had then appeared. At that time, the jambs of safe doors were not provided with steps and the wedges could be driven in. Where location would permit the noise of an explosion, one pound of gunpowder, introduced through a quarter-inch crevice made by one of the wedges, would blow the door out bodily. This little adjunct to the burglar's tools effectively sealed the fate of the then so-called burglar-proof safe and stirred up some feeling of consternation among safemakers and bankers alike.

A similar fate met the introduction of other makes of safes, most of which were protected by various types of patented combination locks. The means employed by the burglar to obtain the contents of the safe were various and successful, according to his ingenuity and initiative. A new method would be guarded by one band of thieves as long as possible, and so it was that cracksmen became known to the police by their work and methods of operation.

By 1865 or 1868, the use of gunpowder became so general that nearly all the safes in coal and wood yards, as well as other business premises in isolated sections of New York City, were blown open. What may be called a fierce competition between the safemaker and the burglar seems to have started about this time, the former attempting to make a safe to withstand the burglar's tools and gunpowder, and the latter to

overcome the new and stronger constructions. This happy state of affairs continued until shortly after the Civil War, when the combination lock became a more practical affair.

The relief afforded by this new introduction was temporary, however, for organized burglary gangs began immediately to collect for examination and experiment a number of these locks, sometimes at considerable cost. Some they found were very easy to master, others required more time, but all were vulnerable. Some burglars soon became noted among criminals and police alike for their extreme cleverness in discovering the combination on this type of lock. The combination lock, however, was made proof against such attacks by the introduction of the time lock in 1874; this mechanism prevented the operation of the bolts, even with the use of the combination, until a predetermined time had elapsed after setting of the lock.

The truce was again short-lived, for dynamite came into use for safe burglary in 1878. The potential force of this explosive is about eight times that of gunpowder, but its action is more local, and where closely confined the noise of its explosion is small when compared to its shattering effect. About this time, however, drill-proof steel came on the scene and in a measure circumvented the use of dynamite because of the difficulty of penetrating this metal with a drill. Cracksmen were more than equal to the occasion, and about 1894 introduced the use of nitroglycerine into safe burglary. This has proved to be one of the most successful methods of any yet known, and is still used almost exclusively where an explosive is to be the means of attack. With this liquid explosive at the burglar's command, the drill was unnecessary and the drill-proof safe soon became an easy prey for the professional cracksman.

Since the introduction of nitroglycerine, other industrial methods and tools have been prostituted to criminal use, including the oxyacetylene cutting torch, the oxygen blowpipe, and others, to meet advances in safe and vault construction. Given time, and by that is meant only a few hours, the most modern enclosure is unable to resist attack.

Burglar-alarm systems had their inception in 1853, when A. R. Pope patented an ingenious device to give signals when doors were opened by interlopers. In 1858, Edward Holmes, proprietor of a notion store in Boston, spent his spare moments studying the mysteries of electricity. Electrical phenomena were then more or less unexplained; the telegraph was in use, but the incandescent lamp was still unknown, and electricity had not yet become one of the commonplaces of life. Holmes bought Pope's patent and began to exploit it in Boston. Soon, however, he went to New York City to try and sell his "new-fangled" device in the larger metropolis. He met with fair success, installing the equipment in the homes of a few wealthy people. It is interesting to note that Alexander Graham Bell sought to attach his telephone circuits to the wires of the Holmes burglar-alarm system in Boston, since that wire system was one of the most widespread intracity electrical communicating systems then in existence.

Holmes's first equipment was designed merely to warn the occupants of a house or store when someone tried to open a door or window. But it also warned the intruder, who could usually make a successful escape after the warning gong began to sound. Holmes reasoned that this defect could be eliminated if the wires protecting the doors were connected with police headquarters or with a central station near by; for, then, when signals were received, trained men could respond and capture the burglar unawares. Thus was born the central-station idea of alarm-system protection.

Many developments and improvements have since been made in electrical equipment and circuit design, and in the past thirty years various types of alarm-system equipment have been made available to persons provident enough to secure its advantages. In November, 1901, the Underwriters' Laboratories, Inc., was chartered by the state of Illinois and authorized to establish and maintain laboratories for the examination and testing of devices, systems, and materials employed in alarm systems, thus giving official recognition to the worth and utility of this type of communication equipment.

The Underwriters' Laboratories, Inc., has since expanded into a national organization and is now the recognized authority on alarm systems. Wherever employed, alarm equipment has invariably reduced losses, a fact that is well evidenced in the lower insurance rates for protected premises.

DEVELOPMENT OF OTHER COMMUNICATION EQUIPMENT

The latest adaptation of an old device to the demands of fast police communication is the teletypewriter. This machine, which is being increasingly used in police as well as in other fields, is no more than a modern improvement of the old printing telegraphs invented by Hughes, Siemens, Creed, and others in the middle of the nineteenth century. After much experimental work and improvement of the apparatus, the telephone companies began supplying teletypewriter leased circuit service to the press associations in 1915. Other commercial uses for this equipment had been found even before the United States Navy adopted the service at the time of the World War. The teletypewriter has proved to be a valuable adjunct to the police communication system. In a number of cities it is the medium of communication between headquarters and the scattered precinct stations, and it is rapidly becoming the instrument chiefly relied upon for long-distance intercity police communication. The teletypewriter is superseding other means of communication in these two specific fields because it combines the speed of the telephone and the accuracy of the typewriter with the authority and permanence of the printed word. This new service first demonstrated its efficiency in the Times Square subway disaster of 1928. The precision and speed with which, through its use, the police headquarters mobilized the reserve forces of several divisions and the patrolmen on duty in many precincts, clearly proved that Commissioner Warren was not indulging in a mere flight of oratory when he characterized the new installation as "one of the most perfectly coördinated communication systems used in any line of business." The results obtained in other cities—Boston, Los Angeles, San Francisco,

Chicago, Buffalo, Portland, and Seattle—have in large measure repeated the New York experience. The further development of county, state, and regional teletypewriter networks marks a new era in the coördination of police agencies and emphasizes the continued growth in use and importance of this instrument in the police field.

In 1902, Major Richard Sylvester, President of the International Association of Chiefs of Police, commented in his presidential address upon the then novel transmission of photographs by means of telegraph wires and prophesied important police uses for this unusual communication process. The problem of transmitting a photograph or drawing over a distance by means of electricity has occupied the attention of many engineers and scientists for more than three-quarters of a century. Of the early attempts to effect the telegraphic transmission of pictures, the system developed by Bakewell is of particular significance. His experiments, which came to the notice of the scientific world as early as 1847, made use of two revolving drums, one at the transmitting and one at the receiving end. The rotation of these cylinders was, as far as possible, synchronized. Upon the transmitting cylinder were placed a thin sheet of tinfoil, upon which the sketch was drawn with a specially prepared ink, and a nonconductor of electricity. The passing of a small metal contact over the cylinder broke and closed the circuit as it crossed the inked markings of the sketch, these current interruptions being passed over suitable lines to the receiving apparatus. Wrapped on the receiving cylinder was a sheet of paper so prepared chemically that the passage of an electrical current caused changes in the chemical composition of the surface, leaving small marks or stains. With both cylinders synchronized, the transmitted current interruptions could be made to reproduce an approximate copy of the original sketch.

Amstutz, Shelford Bidwell, Gaselli, Charbonelle, and other European inventors carried Bakewell's experiments further, but it was not until the mathematical calculations of Professor Arthur Korn, a German mathematician, resulted in an

improved use of the selenium cell, that telephotography became commercially attractive. The metal selenium, when kept at a definite high temperature, usually 200° C, assumes the crystalline state and becomes electrically conductive and senstive to light. In this apparatus, Korn employed for transmission purposes a transparent photograph printed on a celluloid or gelatin film which was wrapped tightly around a revolving cylinder. A beam of light was made to pass through the photographic negative, and thence through a prism which reflected the beam upon a selenium cell. The spiral revolution of the cylinder was so regulated that the beam of light would in time cover all parts of the photograph, the intensity of the light at any instant depending on the density of the photographic film in the part traversed at that moment. The beam of light falling upon the selenium would therefore always vary in accordance with the density of the photograph. The section of the photograph embraced by the pencil of light threading its way over the image was about 3 by 2 millimeters in area; small details could not be transmitted, as several would be encompassed by the beam at one time; and this made it difficult to transmit any but the most simple diagrams and sketches.

The first photograph transmitted by Korn's selenium machine was sent from Berlin to the Paris office of the French illustrated weekly, *L'Illustration,* in October, 1907. A Paris-London phototelegraphic service was begun on November 7, 1907, the first photograph, a likeness of King Edward VII, being sent from Paris to the London office of the *Daily Mirror.* The year 1908 is especially important in the history of telephotography as far as the police were concerned. In that year the photograph of a criminal named Hedermann was telegraphed from Paris to London and published in the *Daily Mirror.* The picture was recognized by someone in London who knew him and who gave information to the police which finally led to his apprehension.

An inventor, Edouard Belin, had for some time been engaged in developing apparatus of his own design for the

transmission of pictures. By 1920, Belin's developments in this field gave positive proof of their value and presaged an event of more than ordinary significance in the history of police communication; for experts closely associated with police service were quick to see the potential value of this device in the transmission of fingerprints and photographs of criminals.

The first actual transmission of fingerprints by wire was done in Paris early in 1921, at the instance of Professor Salvador Ottolenghi, an Italian. Working with two assistants in Paris, M. Belin and M. Rainferi, he reproduced successfully the first fingerprints transmitted by telegraph. The prints, of course, exhibited numerous imperfections; the papillary lines, especially, presenting at various points many fractures, which rendered a comparison difficult. Nevertheless, they were good enough to convince the professor that it would be possible to obtain a perfectly clear image with Belin's apparatus.

Confident of utimate success, he related the matter to Senator Vigiliani, General Director of Public Safety. After an explanation of the possibilities and the benefits that the nation would derive from the use of the device, the director ordered him back to Paris to investigate further Belin's experiments and to make suggestions for necessary improvements. He arrived in the French capital on the first of June, and resumed work with Belin at the latter's research laboratory. On the night of June 3, the transmission of fingerprints from Lyons to Paris with Belin's machine was accomplished with most satisfactory results and these experiments were repeated from the office of the *Matin*. On June 4, other tests were made in the presence of the representative of the Italian Embassy, the Marquis del Vascello, and several Italian and French newspapermen. After critical, detailed examination of the prints, it was concluded that the image had been transmitted with mathematical precision. The French, the Italian, and the international press followed these experiments with great interest. Further transmissions were made

in the presence of M. Beyle, head of the Judiciary Department of Police, M. Baldasarre, technical consultant of the department, and other important officials of the French police. On one occasion Belin was able to transmit from Paris to Lyons the photograph of a convict, with corresponding fingerprints, in seven minutes and twenty-five seconds.

During this period, many police experts had become interested in the new discovery, including Dr. De Recther, Director of the School of Police Science of Brussels, who discussed the subject in the *Review of Penology and Medical Jurisprudence*, and Dr. Stockis, Professor of Medical Jurisprudence in the University of Liège. "The international identification of criminals," wrote Professor Stockis, "is the full realization of a most important problem in the field of public safety, and it should not be considered an exaggeration to say that this discovery constitutes the most precious weapon the police have in successfully fighting international crime."

In 1922, Korn came to Italy, where he continued his experiments with the aid of the Ministry of the Navy. Through the suggestions of Professor Ottolenghi, he became intensely interested in the possibilities of telephotography in criminal identification and subsequently, in many experiments, proved that absolute identification could be made through fingerprint impressions transmitted by wire.

Thus science again placed itself at the disposal of the police, and a new instrument was made available in the development of communication facilities. To the Italian professor belongs the credit for the first recognition of the great potential usefulness of telephotography in police work. From the records, it would appear that this invention grew and developed almost entirely under the guidance of foreign engineers and inventors. To German, Italian, and French scholars belongs the greater credit for its introduction, although it is definitely known that Alexander Graham Bell, American inventor of the telephone, had independently recognized the telegraphic transmission of images as an engineering possibility.

Prior to 1923, the technical staff of American telephone companies had been working steadily on the development of telephotographic apparatus suitable for regular commercial use. In an astonishingly short time—by 1925, to be exact—regular telephoto service was offered to the public of the United States by the commercial communication companies. Although the expense involved at present prevents a general use of telephoto facilities by the police of the United States, the future utilization of this type of communication in police service is certain. In Germany, wireless police telephoto sending and receiving machines have been installed in Berlin and several other cities for experimental purposes. Should the results obtained justify the expenditure, it is planned to extend the system throughout Germany and to members of the International Police Radio System.

With the growing complexity of law enforcement and the increased demands upon the police, there is need for an agency commissioned to foster the development and use of modern communication methods and equipment in the police field. Every effort should be made for the early organization of a national association of police communication officers in the United States, so chartered and organized as to permit its later expansion into an international association. Such an expert body of men could make recommendations to the International Association of Chiefs of Police on questions which are of vital concern to the service. Further, the new association, through its collective power and opinion, would be in a position to initiate proposals for comprehensive police-communication projects which must otherwise wait for the tide to come in. Growth of regional communication systems and the development of a national police-communication network, among others, would be given immediate impetus through the organized efforts of the association. Annual conventions would afford opportunity for the expert presentation of various phases of the complex police-communication problem: many questions in this field await competent analysis. Records of convention proceedings would be valuable documents

and, through their distribution to the profession, would awaken interest in the possibilities of modern communication in police service. Thus may those who see ahead pave the way for others in the general advance toward an efficient police system.[12]

The scientific horizon is being constantly widened. In thousands of laboratories, chemistry and physics are yielding new ideas and discoveries for the advancement of man's knowledge, many of which have a direct application in the field of communication. Toward these the police attitude is one of keen interest, since they know full well that the practical equipment and methods in use today are based upon the innovations and discoveries of yesterday.

With this general panorama of communication in mind, we come to consider at close range, in the following chapters, the conditions which have made the communication system a major factor in police administration.

[12] The ideas expressed here have assumed tangible form, with the recent organization of the Associated Police Communication Officers. Its membership includes communication officers throughout the United States and its strength is rapidly growing. Headquarters are at Indianapolis; Robert L. Batts, of that city, is president (1936).

Chapter II

THE MODERN POLICE TELEPHONE SYSTEM

Because of the dual advantage of telephone communication,—its adaptability to police uses for two-way service between commanding officers and patrolmen, and its instant convenience for calls from citizens,—telephone service in the modern police department has come to be the very backbone of its communication system. It carries most of the communication load, as it should. Although supplemented in police operations by highly specialized communication apparatus such as radio and the teletypewriter, the versatile telephone continues to meet the immediate demands of the police when conversation between two persons at more or less distant points is necessary.

In the setting up of a telephone system, the primary problem is one of economic selection—how to do the satisfactory thing at the lowest cost. Police telephone systems in the United States range in size from the very small village system, which might consist of only a single line or two from the local central office, to the elaborate and complex systems used by the metropolitan police of the largest cities. The smallest-sized system differs in no way from that which serves the general telephone subscriber. The police telephone system begins to be different when the private branch exchange switchboard is introduced.

THE SMALL-COMMUNITY SYSTEM

For the small town, or the city where all police operations are centered in one station, a one- or two-position switchboard will suffice, depending upon the size of the force and the number of call boxes necessary in policing the geographic divisions of the town. Terminating at this switchboard are the lines from the local central office, the extension lines serving telephones used by the officers, the detectives, and the headquarters staff, and extension lines connected with the beat

telephone system. Burglar- and holdup-alarm lines from local banks and mercantile establishments may also be connected to the police switchboard. Many installations of this smaller-community class also provide direct extension lines to the homes of the chief executives of the department and to the central office of the local fire department; and other extensions may be provided to meet special requirements of individual departments.

In planning the telephone communication system for the smaller community, it is important to provide facilities adequate to meet the emergencies that may arise, as well as the routine work of the department. Of great importance is the provision of a sufficient number of trunk lines to the local central office. A single telephone line in use is a barrier to the citizen who is trying to call the police department in an emergency, and quite useless to the operator at the police department switchboard if he wishes to relay a call for assistance to the hospital, to the fire department, or to divisions of the police department. Busy central trunk lines may paralyze an entire department for several minutes when seconds may mean the difference between life and death, or between capture and escape. Adequate facilities to the local central office should be provided well in advance of present requirements so that in emergencies there will be no delay in summoning police aid. Emergencies are not infrequently accompanied by a sudden increase in telephone traffic over the police switchboard, which may cripple the entire system unless provision is made for peak-traffic periods. Switchboards provided by the telephone companies are usually designed to permit enlargement or expansion as the increased business of the department makes this necessary.

THE METROPOLITAN SYSTEM

The large metropolitan telephone communication system is essentially a combination of smaller units of the same type as those used by the smaller cities. These are linked together by tie lines into a larger system, and the operating routine

changed so as to permit the complex and more extensive system to function as simply as the small unit.

For administrative purposes, the large city is usually divided into police districts, or precincts, each one of which is provided with a telephone system comparable to that outlined for the small city. These precinct systems are in turn connected to the police switchboard at divisional or central headquarters by direct lines. In most installations, all call-box extension lines come into the district switchboard, where a record is kept of the patrolmen reporting. In a few cities, beat telephone systems are wired direct to central headquarters. Although the wisdom of this arrangement is open to serious criticism, the number of such installations may increase because of the centralizing effect of radio communication. In a few places, the adoption of radio patrol has prompted the abandonment of substations altogether. Modern police practice, however, seems to favor the retention of a decentralized system so far as beat communication is concerned.[1]

The district or precinct switchboard is provided with the necessary number of trunk-line connections with the central telephone exchange, much the same as in the telephone system described for the smaller community. In order to coördinate the decentralized system in large cities, it is necessary to provide a large amount of equipment at headquarters to tie these scattered units together into one properly functioning whole.

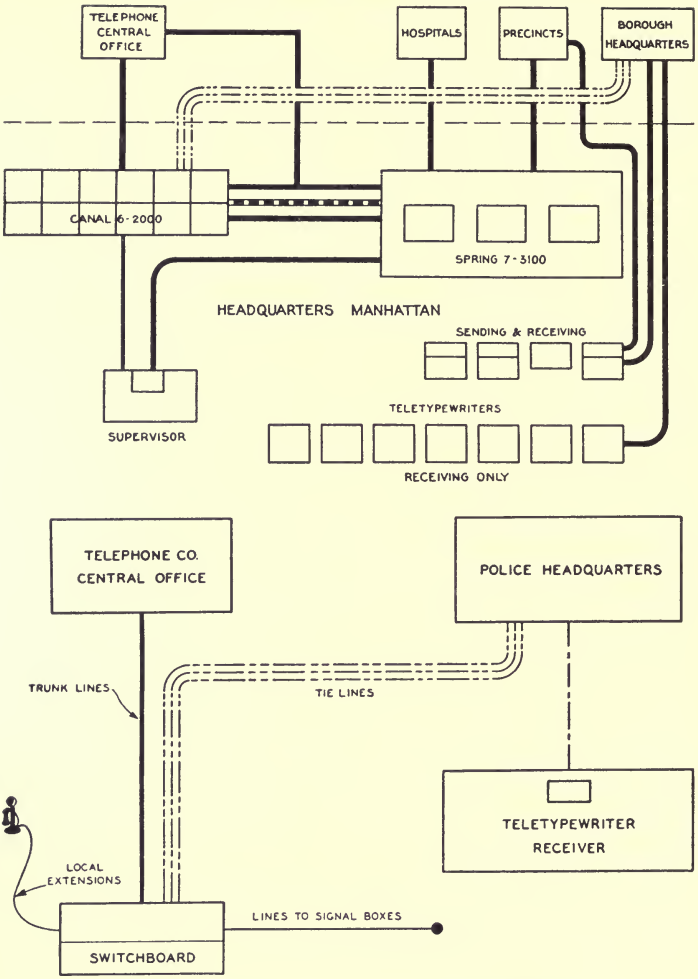
Telephone traffic handled by police communication systems falls into two classes. There are (1) the calls concerned with administrative matters and the ordinary business calls, and (2) the assistance or emergency calls—calls having to do with requests for police aid from the public or from police in other parts of the city and outside jurisdictions. In the metropolitan department where the volume of both types of call is great, they are segregated and handled by means of separate equipment in the communication bureau. In this situation the private branch exchange switchboard is used to handle ad-

[1] See Chapter IX, "Coördination of the Police Communication System" (p. 298).

ministrative calls that require switching and the connection of incoming lines with extension stations, and an order-receiving turret is employed to accommodate with dispatch the calls requiring police action. Where headquarters equipment is thus provided in two units, adequate provision is made for interconnection, so that any calls coming in to one unit may be transferred to the other when necessary.

Order-receiving equipment is designed to permit the speedy answering of incoming calls, and is used where there is no need for interconnection of incoming trunk lines with extension stations or other telephones. Jacks with attendant pilot lamps are mounted on both sides of the turret, each side serving as an operating position. When a call is indicated, the operator plugs in the jack designated by the lighted pilot lamp, answers the call, records the information, and after taking the action necessary to give police aid, is ready to answer another call. The order-receiving turret is also designed to accommodate outgoing facilities. Thus, a police-turret operator may take a call for assistance from a citizen and then call out over one of his outgoing trunk lines, some of which may be private wires to other departments or hospitals, in order to relay the call for assistance to the point where action may be taken. In addition, where the department makes use of radio communication, facilities are provided enabling the turret operator to "cut in" the radio dispatcher on conversations when the incoming crime report is important enough to make this action advisable.

The system described is, to be sure, subject to minor variations, depending upon individual problems and conditions and in some measure upon the ingenuity and interest of those in charge of the Communications Bureau. In Chicago, for example, all incoming calls for police assistance generally arrive at one central turret, the operator of which commands a view of fifteen or more telephone stalls or booths, each manned by an operator and equipped with a standard telephone and direct extension to the radio dispatcher. The operator of this turret answers no calls, but acts as a telephone dispatcher,



Telephone layouts for police headquarters and police department precincts.

switching the incoming call to the operator who at the moment is not occupied. The essential information is recorded upon a report form which is then delivered to the radio dispatcher or to one of a group of operators who handle incom-

ing and outgoing calls to district stations. If to the latter, the information is telephoned to precinct headquarters, from which point the report is finally received by the beat patrolman or other officer for investigation. If there is an emergency crime report, the operator signals the dispatcher, who may listen to the conversation and thus save time by gaining immediate possession of the facts essential for the broadcast.

Most of the crime reports in the large American city arrive by telephone. It is necessary, in order that the police department may give the most valuable service, that these calls reach quickly the point where direct action may be taken. In this respect the telephone communication system of the large police department acts merely as the agent of transfer. Officers in charge of communication are primarily responsible for establishing a routine which will accomplish this transfer quickly and accurately. A satisfactory routine which has been used with success in several large cities may be outlined by tracing a call from its inception to the point of action.

The citizen who wishes to communicate with the police may call the headquarters emergency number direct; he may say to the central-office operator, "I want a policeman," or he may call the number of his local precinct station. Calls made either way should accomplish the same result. If the call comes in to the precinct switchboard, the operator there takes down the details and, if the matter is one of minor importance, turns it over to the precinct organization. If the call is of major importance, he records the details just the same, dismisses the citizen, and telephones the information over his direct wire to the order-receiving turret at headquarters. Here the call is received, a record made, and the matter referred to the proper department: it may go to the radio broadcasting room, the teletypewriter bureau, the detective division, or the hospital. Occasionally several different divisions must be notified, in the order of their importance to the case in hand.

If the citizen says to the operator, "I want a policeman," the call is given to the headquarters switchboard without being sent through the precinct organization. If it prove of

Telephone room at New York City police headquarters. At left, switchboard used for administrative calls; at right, receiving turret for emergency calls. The two are connected, so that calls coming to one may be transferred without delay to the other.

minor importance, the report is referred back by telephone to the district headquarters concerned. If the report is of an emergency, or is otherwise of major importance, it is handled as was the call from district headquarters previously described.

In order that there may be no chance for an error in judgment on the part of the district-headquarters operator, police manuals of procedure specify calls which must be transferred to headquarters, so that an operator willfully failing to dispatch the prescribed information becomes subject to disciplinary treatment. In several cities, all telephone switchboard and order-turret operating instructions are included in the manual of procedure.

OPERATION OF THE POLICE SWITCHBOARD

Since conditions so far have not dictated a special design or construction, switchboards used in police work are the same as those supplied by the telephone company to commercial establishments. These range in size from the small cordless, or "key" switchboards, to the large type of private branch exchange, similar to the central office switchboards in use throughout the Bell system. Telephone engineers, when called upon to make a study, first obtain a record of the volume and kind of traffic, and then decide upon and recommend the proper facilities with which to handle that traffic. To provide the type of service required by the modern police department, the telephone system should be planned properly and operated efficiently. Of these two, the latter requirement is by no means the less important one.

No police communication system can give adequate service unless it is used properly. No matter how many millions of dollars may be spent upon cables, laboratory research, line equipment, switchboards, and other facilities, the quality of police telephone service will yet depend in large measure upon the human element, the operator at the police switchboard. Efficient operation is dependent upon three factors : the selection of men fit for the job, the competent training of these

men, and adequate supervision of the operating task. According to telephone engineers, the neglect of any of these factors usually results in a poor grade of service, and thus retards action and lowers efficiency in every branch of the department.

Since the operator bears such a direct relation to the success or failure of communication in police service, what are his qualifications? Speed, judgment, accuracy, and courtesy are among the essentials. He is responsible for the initial action, and that action must be accomplished without lost motion or hesitation. In emergencies, he is the first to receive information and the operating divisions of the force are dependent upon him for its prompt receipt and transfer.

Furthermore, the value of promptness and dispatch at the switchboard in promoting a friendly public attitude toward the department is of considerable importance. The complainant refuses, and justly so, to stand quietly in line and wait his turn as he would at a theater or railway ticket office. He is in a hurry or he would not be at the telephone and he is so completely overwhelmed with the matter to be reported that he is quite unmindful of competing calls that may be coming in. Any delay is a direct personal affront and makes a vivid impression upon his mind. Later explanations in answer to a citizen's complaint of delay are of little avail, regardless of what they may be, and only tend to compromise the department and its chief executives. It is much better to give prompt service in the beginning.

This necessity of promptness in answering calls and in relaying messages cannot be overemphasized. A minute's delay, often a second's hesitation, may mean the difference between success and failure in a criminal investigation; it may mean the difference between life and death to a citizen or an officer in danger. Stop-watch observations should be made to determine the time interval of response on these calls, and whenever the average is in excess of from five to ten seconds, steps should be taken to correct the condition. Modern police organizations know that speed in answering incoming calls is

imperative; if difficulty is had in getting satisfactory results, the advice of the local telephone company should be requested.

Speed, however, should not be attained at the sacrifice of thoroughness and accuracy. The newspaper editor's admonition to his reporters, "Get it first, but first get it right," can well be given to the operators of a police switchboard. Inaccurate information may mean the sending of aid to the wrong address, time wasted, or even complete failure in an emergency. Inaccuracy may be consistently shown by operators whose judgment and other qualifications are above criticism. Nevertheless, if they make the necessary adjustment only with difficulty, they should be replaced.

In attaining accuracy at the police switchboard, clear pronunciation and a resonant voice are essential. Much of the difficulty in connection with numbers is eliminated by separating the hundred by means of emphasis; for example, 1234. A rising inflection sustains the sound so that it reaches the hearer clearly. It also helps if the voice is raised in a questioning tone on the last digits of numbers and when answering calls; for example, "1234? Police?" It is not hard to speak clearly and distinctly, giving proper form to all the sounds which make up every word and number. Given a voice with average tone and resonance qualities, maximum clearness is produced by speaking in the ordinary conversational tone, with the mouth a half-inch from the mouthpiece and directly in front of it. Increased volume causes distortion. Shouting into the mouthpiece generates a sound congestion and excites the transmitter to the point of saturation and beyond, making intelligible speech difficult if not impossible.

In the record procedure of an increasing number of police departments, the memoranda made by the operator in receiving calls for the police are the basis for the police master complaint record card. This card is usually typewritten on a prescribed form as soon as the operator has taken the action required by the call, and is given a consecutive serial number. Investigating officers assigned to the call file written reports bearing the same serial number, and these are attached to the

original complaint card, forming an orderly and complete record. Although actual record procedure is as varied as are police departments, in most of them the original information obtained by the operator subsequently becomes part of the permanent police record.

Inaccuracy in the information set down by the operator, it is easily seen, may cripple the record system. Some letters of the alphabet have a phonetic similarity, and where there is a possibility of error the questioned letter should be specifically identified. The most useful method is much the same as that used in broadcasting reports of stolen automobiles: "Calling all cars, a stolen auto, license 6-B (B as in Boy) 6346." Under the most trying conditions, this simple expedient will enable the operator to obtain exact information.

Good judgment is imperative in efficient switchboard operation. The daily routine of the police operator is sharply punctuated with emergency situations, and the ability to make rapid-fire decisions in a crisis is among his first qualifications. He should have poise, alertness, and unfailing presence of mind. The emergency is the supreme test of a police communication system; it is equally the proving ground where the individual either qualifies or is eliminated as an operator.

On the balance sheets of large corporations, the value of good will, that intangible asset, is sometimes expressed in six and seven figures. In police work, courtesy in human contacts pays big dividends. The mandate of some police departments, "Kill them with kindness," might with profit become a part of the police code of ethics in many others. The police-exchange operator is in a position to do as much as any other person in the organization, if not more, in introducing courtesy into the department's contact with the public. He should be able to replace friction in conversation with the ease of politeness. It is not difficult to converse politely with a citizen whose attitude for the moment is colored with malice and complaint. The person with a "chip on his shoulder" is correspondingly weak, and the person with an even temperament, inherited or

acquired, is thereby the stronger and will dominate the situation. Adroit and tactful conversation may win a permanent friend for the department. Retaliatory conversation arouses antagonism and wastes time; there should be brevity but not abruptness. Politeness by no means implies a lack of firmness; the two qualities are not contradictory, but supplementary.

It is the policy of every organization to win friends and to hold them. The police operator can promote friendly relations with members of the community by cultivating the habit of distinct speech and a pleasant tone of voice, devoid of any indication of haste or impatience. A courteous attitude will go far in convincing a citizen that the department exists to protect him, his family, and his property from harm; it will reassure him in his difficulties, and secure his willing coöperation.

Many observers of human behavior believe that the voice is a potent factor in expressing personality. Speech is a delicate, subtle, and powerful form of behavior; therefore the way in which a thing is said, and the sound of it, are often as important as the message. It is said that Joseph Conrad, on hearing two sailors speak English in the darkness, adopted it as the language of his choice. The listener is apt to evaluate the department in terms of the person with whom he speaks.

In the selection of police operators, the approved practice in the more modern police organizations is to recruit operators direct from the force, since experience as a patrolman is very desirable in this type of work. Sometimes lay candidates who have a preference for police work and would be willing to take its responsibilities seriously are given the opportunity. Good hearing, of course, is essential. Usually, however, the operator selected has a good record of two years on the force, or the time spent on police duty is sufficient to have given him a fair knowledge of the department's operating procedure. A prominent police executive on the Pacific Coast selects for operators men who give promise of being advanced to higher positions. His reasons are two: (1) the value of experience at the police switchboard, and (2) the fact that qualities and capabilities which foretell a probable advancement

in police work indicate the person's fitness to be an efficient operator.

The proper men having been selected, they must be adequately trained. Not enough attention has been given to the intelligent training of police officers for work at the switchboard. The prospective operator too often receives a minimum of instruction and must work out his own salvation. It is like placing a new recruit on patrol duty without first having him work under the supervision of a patrol sergeant.

Correct training is usually divided into three stages, which may be varied with different individuals: listening-in with an auxiliary set of headphones at the switchboard that he will later operate, classroom instruction, and actual practice in handling calls under supervision—all under instructors thoroughly experienced in operating practice and technique. After a certain amount of classroom instruction, practice, and listening-in at the main switchboard, the neophyte operates a position at the switchboard during light traffic hours under an experienced operator. Police calls are of no set type. They vary greatly, and the best instruction is that which includes the actual operation of the board, although this should not be undertaken before the operator has mastered the mechanics of switchboard technique. Pamphlets dealing with the mechanical arrangement of the switchboard and its operation have been published by the telephone companies, and police departments have only to ask for them.

Local telephone companies often admit police operators to their private branch exchange operators' training school, and in several of the larger cities instruction in switchboard operation is included in the curriculum of the police school, as it is in New York, where training apparatus has been supplied to the police department by the New York Telephone Company.

Correct supervision of the operating force is essential to all good telephone service. This is even more important with men than with women operators. Good supervision keeps an adequate force on duty at all times; it insures attentiveness to

the work in hand, courtesy in handling calls, and thoroughness and accuracy with respect to the details of each call handled. Without these things, the service cannot be of the best.

Auxiliary to the police switchboard are the "records" which serve as a means of ready reference to the operator on duty. These auxiliary records expedite communication operations tremendously, and the best police organizations supply them to the operator. Besides the local telephone directory, they generally include the items named in the accompanying list (p. 66).

It becomes a simple matter to arrange these records so that all the information necessary in emergency situations may be found quickly.

WOMEN AS POLICE OPERATORS

For several years after the invention of the telephone, when exchange telephone service was first coming into use, switchboards were operated by men. This arrangement was short-lived, however, for the operating companies found that women were better adapted to telephone operating. Both men and women are employed as operators of police switchboards. The women are considered the better telephone operators; yet their assignment to the operating position has definite disadvantages.

Women are quieter, they have natural aptitudes suitable to switchboard operation, and their employment as police operators has the over-all advantage of affording a higher and more uniform grade of service in some respects, as well as a more courteous service. Their employment may also be favored for economic reasons; generally, women telephone operators can be employed at a rate of pay below that received by the police officer who has been taken from the ranks to perform this type of work. A position at the police switchboard, however, involves more than mere switchboard operation. Women assigned to such positions should undergo intensive training if they are to perform efficiently the functions of a *police* operator. Training is necessarily costly, al-

LIST OF AUXILIARY RECORDS

1. Telephone directories of near-by cities and towns
2. City directories
3. Day and night telephone numbers of all department executives
4. Home address and telephone number of every member of the department (two lists, one alphabetical and one geographic by residence)
5. Complete list of hospitals in the area served
6. List of local physicians, including County Physician and Health Officer, who may be available in an extreme emergency
7. Telephone numbers and addresses of executives of all other municipal departments, such as Recreation, Health, Welfare, etc.
8. List of outside ambulances
9. Telephone number and address of coroner
10. Copy of plans and maps covering operation of the police department under disaster conditions
11. List and spot map of all police telephone boxes
12. List and spot map of police recall signals
13. List of office intercommunication telephones
14. List and spot map of all bank, holdup, and burglar alarms installed in the area
15. List and location of all fire-alarm boxes
16. List of all banks and telephone numbers of their principal executives
17. List of all private night watchmen aand private patrolmen
18. List of principal mercantile establishments which are special police hazards, such as jewelry stores and theaters, with night telephone numbers of proprietors and managers
19. List and telephone numbers of outside police departments in the immediate area
20. Location of all safes in the area
21. Telephone numbers of nearest military authorities
22. List and telephone numbers of available experts—chemists, metallurgists, geologists, and other specialists, who can be relied upon for immediate response
23. Maps. (The operator should have conveniently beside him a map of the area served, showing beat boundaries at different periods of the day, names of streets, and with the 100-blocks designated. This should be supplemented by an individual map of each police beat, which, besides the names of streets and the 100-block designations, should show the location of potential emergencies and principal police hazards. Auxiliary diagrams and plans should be available for each major contingency, outlining a covering plan in the event such emergency materializes.)
24. List of all public and private schools in the area
25. Other lists and maps as dictated by the experience of the department.

though the cost should not outweigh the savings represented in lower salaries. Again, because of the control by communication of the movements of the force, the operator in many organizations is virtually the director of their operations, dispatching and concentrating officers at first one point and then another, as the usual procession of emergencies comes to the attention of the police. In such situations, the abilities of an executive are required in order that the movements of the force may be directed to the best advantage, and it is here that experienced officers may be assumed to possess the advantage as police operators. Furthermore, switchboard operation can be rated as a valuable training ground for members of the force. Ordinarily, the duties of the operator give him a perspective of the general operations of the organization not afforded by any other position in the department. With this idea in view, the executive of one Western organization rotates assignments in such a manner that each member of the force may serve at the switchboard.

Generally speaking, the evidence indicates that in the best-organized police departments there is a preference for male operators. The final decision on this matter, however, must await the results of further experience. Women police operators are still employed in many departments throughout the country and many of them have proved equal to the task in emergency situations.

OFFICE INTERCOMMUNICATION

The administrative communication system in a police department functions much the same as that in any large commercial organization, and the private branch exchange system is used by both. But that part of the telephone communication plan which has to do purely with matters concerning police action—the emergency system—shows many differences. The correct use of the administrative system lies chiefly in the recognition of these differences and in the solution of the problem of how to keep the administrative system from impairing the efficiency of the emergency system.

Tie lines, connecting outlying offices with headquarters, are usually provided for handling emergency calls, and should be reserved for emergency information demanding quick action. If employed for the usual routine calls in connection with administration, they are apt to be busy when an emergency call is received—and thus the vital purpose for which they were provided is frustrated. All calls relating to administrative matters should therefore be handled over the central-office trunk lines and not over the tie lines.

This problem of the restriction of certain functions to each unit is bound up with the larger necessity for adequate facilities, no matter what they are to be used for. This is imperative for the emergency system and highly desirable for the administrative system, as the police administrative force hampered by inadequate telephone facilities functions just as poorly as the business concern handicapped by the lack of specialized telephone equipment. Every person on the administrative force who has need of a telephone should have access to an extension and not be forced to neglect other duties while searching for a telephone to use. Efficiency is as essential in the office as on the beat. In the best-designed installations, provision is made for the connection of all headquarters telephones to the headquarters switchboard; but there are certain exceptions, as, for example, officers engaged in confidential criminal investigations. These officers have private telephones connected directly with the central telephone exchange, and the numbers of these phones are not listed in the telephone directory—nor are they generally known. They are used chiefly for outgoing calls. Only subordinates reporting directly to the executive officer in charge of an investigation have access to them, as a rule, and limitation of the number of these users may sometimes be desirable.

Just as the large business organization does, so the police office can profitably make use of special communication-equipment facilities that are to be had from the local telephone companies. These include wiring plans, jack-and-plug arrangements, code-calling systems, special visual signals,

and other accessories to the office telephone system. They are used where there is a definite need for equipment auxiliary to the ordinary private branch exchange system and usually are installed on the recommendation of telephone-company engineers after a study of the particular conditions.

Wiring plans are low-cost arrangements which, when properly designed to fit the needs of a particular subdivision of the police department, add greatly to the efficiency and convenience of its telephone system. Wiring arrangements now standardized by the telephone companies permit of the police executive's having any telephone connected with any one of two or more lines for use on the line not busy; for the transfer of calls from one telephone to another; for answering any or some of the office telephones from another telephone; for intercommunication with inside telephones; for talking over one telephone with the assurance that the conversation is not being overheard by anyone at any of the other telephones in the arrangement; for holding an incoming call on one line while he talks over an outside line or communicates with an associate without being overheard by the calling party; for having his secretary or attendant receive incoming calls, hold the line, and transfer the calls, after which the secretary's telephone is cut off; for listening in by the secretary, who may take notes on the conversation.

Jack-and-plug arrangements are useful in any bureau where the files cover an extensive area. By means of this arrangement, information file clerks with small convenient headsets may receive a call, ask the person calling to hold the line, and, by plugging the headset in a jack near the file which contains the information, resume the conversation while consulting the records.

The code-calling system is used as an auxiliary to the main switchboard to notify persons who may be absent from their usual posts that they are wanted. To each executive, and to any other person likely to be called, a code number is assigned. On receiving a call or other request for a person who cannot be reached on his regular telephone, the operator at

the switchboard depresses a key on the code signaling box, which causes a code signal to sound in various parts of the building. When the person called hears this signal, he goes to the nearest telephone and communicates with the switchboard operator, who connects him with his call. Direct circuits connect the code signaling box on the main switchboard with signaling devices throughout the building and at other places where circumstances warrant it. Gong, bell, muffled chime, or any other audible signal device, sounds the proper code. Visual signals are installed where silence is necessary or desirable. A separate code signal, or the use of a distinctive gong supplemented sometimes by a visual signal, is employed by some departments for spreading quickly a general alarm throughout headquarters offices. Such a system may also be provided with a selective keying arrangement, whereby only certain details or divisions may be notified of the emergency, such as the homicide detail, or robbery detail.

Special precautions are often necessary, as in detention cells or jails, with which police stations are usually equipped. The alarming increase in the frequency with which desperadoes escape from county jails and city prisons should be reason enough for taking at least the more ordinary precautions. At little expense, a jail can be so protected by a communication network that such deliveries become physically impossible, even though the attempt may have the assistance of corrupt jail personnel. With a proper communication system, any irregularity in normal routine is sufficient to set in play a silent alarm at certain near-by points, foil an attempted jail break, and perhaps, if escaping prisoners should show armed resistance, relieve the trial courts of any further concern in the matter. Suitable detectors, with connecting lines, may be installed so that officers may be forewarned of any unauthorized tampering with jail equipment or of an attempt at escape.[2] In addition, concealed footrails, push buttons, or similar devices, may well be placed at convenient places in the jail section, in order that the jailer may signal for assistance

[2] See Chapter VIII, "Burglar- and Holdup-alarm Systems" (p. 266).

in emergency. Some jails are provided with the familiar dictaphone installation, by means of which officers at some remote point can listen in on conversations between prisoners confined in cells.

In order to provide this protection in the larger jails and penitentiaries, more elaborate intercommunication systems have been developed, designed not only to secure control over persons within such institutions, but also to minimize the possibility of a serious prison fire or a prison break. Typical of this kind of installation is the prison paging and patrol system recently put in operation in the county jail at Los Angeles, Calif., where a centrally controlled network of many audible and visible signals and extension telephones permits immediate contact with all persons on duty in the institution and enables the operator to transmit quickly emergency alarms of various kinds.

A system of this type also provides a means for supervising the activities of the prison patrol force. By its use the central office can get in touch with any or all prison officials, sound emergency alarms, and, in an emergency, control the movements of the entire force. The guard in making his rounds is required to push the button of each reporting station on his tour. The pushing of this button illuminates a corresponding number at the central station, and the illuminated number of the preceding push button becomes dark. As only one number for each section is illuminated at any one time, the central-station operator always knows the last station at which the guard pushed a button. These reporting stations are placed at intervals of fifty or sixty feet, and telephones are made a part of every third or fourth reporting station or placed at strategic points. The obvious value of such intercommunication systems is being recognized by public officials, and installations of this type will no doubt increase in number.

LONG-DISTANCE TELEPHONE COMMUNICATION

Since January 7, 1927, when transatlantic telephone channels were officially opened by the American Bell Telephone

Company, the telephone field has constantly widened. Today this long-distance communication system uses more than 33,000,000 telephones, or about 92 per cent of all telephones in use throughout the world. The area thus served covers most of North America, much of South America, all Great Britain and Northern Ireland, almost all Europe from Brittany to the Black Sea, Australia, and cities in Africa. It includes, moreover, the islands of Java and Sumatra in the East Indies, Sicily, the Canary Islands, Bermuda, and the Hawaiian Archipelago. And a number of large passenger liners while at sea maintain telephone contact with this great network through ship-to-shore service.

Although the cost of long-distance telephone service has been a prohibiting factor, this service has played an important rôle in police work for many years. As a means of direct conversation between distant points, its strategic value in emergencies has been demonstrated on numerous occasions. As in other lines of endeavor, situations frequently arise in police service where direct conversation is the most expeditious means to the end desired, and on such occasions the long-distance telephone is a ready instrument.

COMMERCIAL TELEGRAPH AND CABLE LINES

Supplementing the telephone in long-distance communication, of course, are commercial telegraph and cable lines, which penetrate every corner of the civilized world. In almost every major criminal case in the past twenty years, telegrams have been used to relay important information or to request the investigation and apprehension of criminals. In the absence of a national communication network operated exclusively by the police, the importance of the commercial telegraph in police service is not to be minimized.

All the important cities in the United States are now interconnected by direct trunk telegraph circuits equipped for automatic machine operation. Two general classes of telegraph service are available, designated as "Immediate" and "Deferred." The "Immediate" service includes the standard "tele-

gram" or "full-rate message," which takes precedence over all other classes of traffic, and the timed-wire service, described below. The "Deferred" services include the day letter, the serial, the night letter, and the night message.

The full-rate telegram represents a fast service for all communications when speed is an urgent requirement. Full-rate telegrams are accepted at any hour of the day or night for immediate transmission and delivery. Serial service is the sending of several communications to one addressee in the course of one day; for example, a running story written by a newspaper man during the progress of a news event and sent to his newspaper in short sections.

Serial telegrams, as the name indicates, may be filed in sections during the day, and the number of words is unlimited. The minimum charge per day is for fifty words, and in determining the total charge the individual sections are counted as having a minimum of fifteen words each. The rates are about 20 per cent higher than for the day letter. The number of words used in the series of messages (each counted as having at least fifteen words) is totaled and the charge made is at the basic rate for the first fifty words, plus one-fifth of the basic rate for each additional ten words or less.

Timed-wire service consists of the transmission, by means of a perforated tape, of a message received in the telegraph company's operating room from a printer telegraph apparatus operated by the sender and destined to a printer telegraph apparatus on the premises of the addressee. The charge is based on the time consumed by the sender in transmitting the message to the operating room and on the distance to the point of destination.

The day letter is employed for communications of some length the nature of which permits them to be subordinated slightly in transmission to the fast-telegram traffic. The cost of a 50-word day letter is only one and one-half times that of a 10-word fast telegram. One-fifth of the initial 50-word rate is charged for each additional ten words or less. The night letter is an overnight service for messages of some length which

will serve their purpose if delivered the following morning. Night letters are accepted at any hour of the day or night up to 2:00 A.M., for delivery the following morning. The charge for the first fifty words or less is the same as for a 10-word fast telegram, and one-fifth of the initial 50-word rate is charged for each additional ten words or less. Night messages are, in effect, short night letters with a lower minimum charge, the initial charge being for ten words. Like the night letters, they are accepted at any hour of the day or night up to 2:00 A.M., for delivery the following morning.

Of the various types of message service available, the full-rate telegram, day letter, night letter, and night message are of primary interest to the police in the solution of their long-distance communication problems. However, it is possible that, in the future, timed-wire service may be adapted to police requirements through the development of a national police network to supplement teletypewriter networks already in operation.

Almost all police telegraphic communications concern one phase or another of criminal investigation, a circumstance which involves peculiar requirements in respect to the content and composition of messages. Experience has shown that little thought is given to the technique of message composition, with the result that frequently the received message is so confusing to the reader as almost to require decoding before intelligent action can be taken. This situation is due primarily to lack of uniformity in police practice. Standard information, such as personal descriptions and fingerprint formulas—more often than not a part of police telegraphic communications—should be reduced to a standard order and form, so that delay and confusion may be eliminated. The growing use of teletype communication by the police is stimulating development in that direction.

While brevity is, for economy's sake, always desirable in writing telegrams and can usually be achieved without impairing the value of the communication, it should not be carried to such an extreme that the addressee will be in doubt of

the sender's exact meaning. All messages should of course be written legibly and typewritten whenever possible. Inasmuch as the ordinary marks of punctuation are not transmitted in telegrams unless the sender demands and pays for this privilege, it sometimes happens that a possible combination of sentences may be confusing; it is then advisable to insert some such words as "stop" or "period," in order to clarify the meaning. Figures are counted as one word each in telegrams, and economies can accordingly be effected by using words instead of figures. For example, the number "50," if transmitted as the word "fifty," is counted as one word instead of two. The substitution of words for figures also tends to ensure greater accuracy in the transmission of a group of numbers.

Codes are ordinarily used in telegrams for two purposes, economy and secrecy. The general use of codes by police departments requires that code books be available at all points to which such messages might be sent. These books very often get into the hands of unauthorized persons, with the result that attempts to secure secrecy by this method are not attended with striking success. In the interests of economy, the use of code might conceivably be of some value, as the police employees who handle the messages would, as a rule, be available to code and decode them without additional cost. This, however, requires time. On the whole, therefore, although police codes are available for telegraphic communication, it is seldom that their use is considered really necessary.

Chapter III

THE BEAT AND ITS EQUIPMENT

The trend in modern police organization is toward almost complete decentralization, and the accompanying recognition of the individual patrol area or beat as the basic functional unit has emphasized the importance of communication in the police department of today. A recent survey of the personnel of the police departments in 390 cities[1] showed a combined numerical strength of 45,689; of this number, 20,791 were patrolmen assigned to beats. At any one time, therefore, approximately half the entire strength of the normal police department is dispersed in the field and lost to its commands except through whatever means may be provided for communication between the station and the beat.

The functions of the beat communication system are closely associated with the administrative plan of decentralization and distribution of the force. For the better supervision and control of the force in large cities, the area policed is divided territorially into divisions and precincts. Each precinct is under the command of a superior officer, usually a captain, who is responsible to the divisional commanding officer, and he, in turn, is held accountable to central headquarters for the "state of affairs" in his jurisdiction. Besides facilitating the physical distribution of the men, the division into these smaller areas breaks up a large, unwieldy force into comparatively small units, each the equivalent of an ordinary community, in which crime prevention and crime detection are the direct responsibility of the commanding officer. The area is further decentralized by the division of precincts into sections and sections again into police beats or posts, the fundamental units of police service. Each beat or post consists of a specific well-defined area traversed by a patrolman. The responsibility of the patrolman assigned to a beat is exactly the same as that of the officer in command of a precinct. In smaller communities

[1] August Vollmer, unpublished manuscript.

where all police activities are controlled from one station, the area is divided into beats in much the same manner as that described for precincts in the large city.

Obviously, the geographic allocation of beats is a matter of great importance in distributing the patrol force of a police department. The selection of the beat as the point of attack in all police operations conforms to the fundamental principles of military strategy, namely, breaking the problem into small units and providing for a concentration of power at those points where the strength of the opposition is most in evidence. The existence of the beat rests upon the conviction that effective patrol service is the foundation of police organization. The individual patrolman is society's first line of defense against the criminal.[2]

Because the beat is the fundamental unit of police organization, the communication requirements in the beat area proper present a problem. The objective is a flexible means of two-way communication between the beat and the station. This would be a simple matter were it not for the fact that the beat patrolman in the modern organization is no longer assigned to a fixed post; he is on patrol in the true sense of the word, moving continuously from one part of his beat to another as an outpost of the crime-fighting organization. Hence, a necessity for the location and distribution of communication facilities throughout the beat area. Further, two-way communication on the modern police beat means more than provision for a two-way conversation between the patrolman and his station, a service which is made possible by the installation of police telephones at several points in the area patrolled. There must also be some reliable means which in emergencies will permit headquarters to notify the patrolman that a two-way conversation is desired. This is accomplished through the recall system—by the installation, at various points in the beat area, of signaling devices which, when operated by the control mechanism at headquarters, will attract the attention of the officer on patrol. Although the two types

[2] August Vollmer, *The Police Beat.*

of equipment have separate functions, they are complementary to each other, and the experience of police departments has proved that the absence of either facility is detrimental to patrol efficiency.

Municipal officials generally, and even police-department officials, greatly minimize the importance of adequate communication between the station and the patrol force. This may be due in some measure to a lack of understanding of the fundamental principles and the scope of the purposes for which such systems have been designed. They are not intended to make the work of the patrolman more laborious or exacting, but rather to provide a helpful facility for the performing of his work with greater ease, safety, and certainty, one through which he can make himself more valuable and important to the community. Communication is the instrument through which the scattered force of the department may be mobilized for concentration in emergency situations. In the normal routine of police business it expedites operations generally, and in the elimination of delay it makes possible economy both of time and of man power. Under existing conditions and with the specialized subdivisions of police work, the number of men available for actual patrol duty, in proportion to the amount of work to be done, is much smaller on the average than it was twenty or more years ago; and it is therefore sound—indeed imperative—administrative policy to increase the availability and effectiveness of the beat patrolman.

THE BEAT TELEPHONE SYSTEM

As in its early history, so today the police call box on the beat has two uses: the regular reporting of beat patrolmen, and the sending of information from the station house. Ordinarily, patrolmen working in eight-hour shifts are required to report to the station over a beat telephone at a specified time, usually once each hour during their tour of duty. Although the reporting interval varies somewhat with different departments, there is general agreement that it should not exceed one hour. Some departments have adopted a 40-minute re-

porting interval, and a few a 30-minute one. In some organizations, calling times are staggered so that members of the patrol force may be available to the station at close intervals. This procedure also prevents a congestion of calls at the switchboard. In a period of impending emergencies, patrolmen may be instructed to call in at much shorter intervals, as the situation may require. Whatever the time interval may be, the patrolman calling the station reports his number to the operator, and receives and executes instructions.

The requirements of police telephone service are quite different from those of commercial telephone service. In the latter the central office, or the telephone exchange, as it is commonly called, is the medium through which all calls are handled. Inasmuch as all calls terminate at some point beyond the telephone exchange, the exchange equipment is designed to interconnect the circuits of the system so that any two parties may carry on a conversation. In police communication practice, particularly where the system is limited to a single police district, as is true in most municipalities, all calls originate or terminate at the police station.

"Pulling boxes" has always been an important part of the service available through the call-box system. In view of the future possibilities of protective police work and patrol service, it will, with some modification, gain in importance. In the early types of call systems, as indicated in an earlier chapter, "pulling boxes" was entirely mechanical. An officer in making his hourly report would press the proper signal button, and then pull down the lever of the code-sending mechanism, and the call would be transmitted to the station, there to appear on the record tape. Identification of the signal box from which such a report was made was possible only when the box number was included as part of the signal. Substitutions could be made, someone other than the required patrolman pulling the box. Very little improvement has been made in this type of equipment, other than the use of a time stamp for part of the box record call in place of the earlier requirement of writing in the time. There is also the possibility of

functional trouble with the calling and recording equipment. The telephone has therefore come to be the principal link between the station and the beat.

Three requirements govern the selection of police box telephone equipment: the instrument selected must give a good grade of transmission to the station switchboard; it must be housed in a waterproof cabinet so as to prevent damage from weather conditions; and it must be simple enough to be easily operated and maintained. Several kinds of police telephone sets are available which adequately fulfill these requirements. The set usually employed in the United States consists of a standard telephone mounted in an iron casing which shelters it from the weather and ensures its operation under adverse conditions. It may be equipped with signal bells somewhat louder in tone than the ordinary telephone set, so that the patrolman on the beat, if known to be near the box, as when temporarily assigned to a fixed post in emergency situations, may be summoned without delay to communicate with the station.

As a general rule, the box which houses the equipment is provided with a lock mechanism, making it accessible only to authorized persons who possess the right key. In a few American cities, the box is left latched but unlocked, so that citizens may use the telephone in reporting an alarm to the central station. Accessibility by the public to police equipment, however, has marked disadvantages, and the best American organizations look upon it with some disfavor. In this country, besides, the great number of private telephones in use has almost eliminated any necessity for making the beat telephone accessible to the general public. In almost all European countries, on the contrary, where somewhat different conditions prevail, public use of the police field telephone is considered one of the primary purposes of its installation.

There are also special types of police call boxes, equipped, in addition to a telephone connection, with various signaling devices for the use of patrolmen and, in some types, for the public as well. One unit designed for this purpose combines

the telephone and the automatic telegraph, thus providing facilities whereby a patrolman may send to headquarters three or more distinct calls—a duty report call, an emergency call for the police patrol conveyance, an emergency call for the police ambulance; a telephone call; and such other calls as may be dictated by the local plan of operation. A selecting device on the instrument enables the sender to transmit the appropriate call. There is a preference for the use of the telephone exclusively, since, besides other advantages, conversation permits the transmission of calls with as much dispatch as with automatic telegraph equipment, and identifies the sender, besides.

Once exclusive use of the telephone has been secured, no particular addition to terminal equipment at the station is required, all beat telephone lines coming in to the telephone switchboard, where calls are received in much the same manner as those on other extension telephone lines to offices in the same building. In most of the automatic telegraph installations, terminal apparatus includes automatic recording equipment, which makes a permanent record of the time, place, and nature of the call transmitted from the beat. It is asserted that this arrangement has the advantage of recording a signal which may be used later in court, or for other purposes, but experience shows that few departments have had occasion to make use of such records and that therefore the additional expense involved is hardly justified. Undoubtedly there is, and will continue to be, a limited field for this type of apparatus in police service. Many banks, theaters, stores, and other mercantile establishments desiring a secret and efficient means of registering an alarm at police headquarters, have installed such equipment for their own protection.

EQUIPPING THE BEAT

There is as yet no scientific basis for the location and distribution of police-beat telephones in American cities, nor is there any evidence to indicate that foreign countries have applied definite principles to the problem. This confused situation

exists in spite of the fact that a blind distribution of telephone units on the beat may defeat the purposes of the installation. The policy in most departments has been to install telephones at approximately equidistant points throughout the beat. Usually, where equipment is available, boxes are placed at about half-mile intervals, without regard for factors which, if properly considered, would materially alter the plan of distribution.

In considering the prospective location and distribution of this equipment, the executive should not only have a general idea of the needs of the different beats, but also should correlate these needs with the particular requirements of the entire area served by the department; it may easily turn out that an equitable distribution of telephones will make possible an advantageous realignment of beat boundaries. Further, the crime records in the entire area should be classified according to the various offenses recorded. This study should cover a period of not less than five years, and the data pertaining to the respective beats should be noted in order to discover those areas which seem to be the greatest potential sources of lawlessness. Spot maps showing the concentration of the different classes of crime are of material assistance in such a study, as are statistical charts and diagrams portraying variations in existing beat boundaries as between patrol shifts; offenses and arrests by beats; offenses per square mile per thousand population; comparative relationship between density of offenses and arrests, and the relative size of beats; variation of offense and arrest density as between patrol shifts. Other factors may demand consideration at this preliminary stage of the plan, but an analysis of the beat origin of offenses reported to the department for a period of five years will provide a fairly accurate index for at least the preliminary plan for a general division of equipment.

After a fair apportionment of equipment has been made for the individual beat areas, there should be determined those points on the beat where telephone installations would be of the greatest strategic value. Ingenuity as well as judg-

ment is necessary here, and again the geographic origin of offenses is significant. We are now concerned with the distribution of offenses within the beat, in order that adequate equipment may be provided in those particular parts of the area where crime is a chronic condition, or where potential emergencies are indicated. Special watch must be kept constantly for police hazards. There may be within the boundaries of the beat potentialities for riots, rendezvous for criminals and prostitutes, low-rent areas, concentration of foreign elements, restricted sections for colored people, and districts inhabited by the transient or migratory class. A study of such hazards should supplement the analysis of crime origin, although it will in general be found that the two are parallel.

Cognizance should also be taken of county and state highways and of other important arterials that may traverse the beat, of shipping docks, ferry landings, and stations of interurban and longer railway lines. Residential sections of particular interest to the burglar, theaters, banks, jewelry stores, exclusive mercantile establishments, apartment houses, and hotels must be noted. In fact, all those elements which enter into the definition and construction of a police beat influence also the location and distribution within the beat of the police telephones. Near boundary lines, telephones may be placed at the conjunction of two beats, making them available to two patrolmen. Accessibility is another important factor to be taken into account. A sufficient number of instruments should be maintained to make it unnecessary for the officer on patrol to extend his beat solely for the purpose of making a telephone call.

Experience has proved that the number of signal boxes in any one area should depend upon the requirements for proper control of patrol operations and of the time response when calling officers in an emergency; on beats in congested districts, the call boxes must be closer together than in districts where much larger beats are practical. Likewise, the urgency for reaching an officer will, as a rule, be greater and arise more frequently in the more congested districts.

With the foregoing in mind, and in order that the elements involved in planning the density of telephone distribution may be more readily understood, arbitrary time-response elements can be used as a guide in determining relative distances. In the congested business areas the time element might be two minutes; in areas somewhat less congested, three minutes; and in the rest of the precinct or community it should not exceed four minutes.

Each time element is the measure of distance that a man can walk within the time indicated. A patrolman on duty will average about 80 steps a minute; each pace will cover about 26 inches, a total of 173 feet a minute. When answering a call, he should be able to increase his pace to 110 or 120 steps a minute with an average of 30 inches to each step. At this rate, using the smaller of the two values, he will cover 275 feet a minute. The last-mentioned "distance per minute" is the measure to be used.

The time-response elements employed should not, however, be the maximum time in which any call box can be answered. The time value used should be the average time required by several men in answering calls. When a number of men are called, it will be found that the answers to a general call will be spread out over a period of time greater than that estimated, and that the average time of all the men called will be very close to what it should be, since at any given instant the distance to be covered by each man in reaching a beat telephone will vary. The greatest distance that a patrolman has to walk in answering a call will be half the distance between two telephone boxes. Where there is a uniform distribution of telephones in a relatively large area, this halfway point may be equidistant from as many as four telephones.

To determine the actual distance between beat telephones for any given time response, it is first necessary to convert into feet of travel the distance that patrolmen will cover in the time allowed. This value will be half the total distance between boxes. However, if the unit of time response used is to be considered as an average, an addition must be included

to offset the answering calls that will come in under the set time allowance. An increase not exceeding one-third of the total given will be sufficient for this purpose.

For a two-minute time response, the total distance between beat telephone boxes will therefore be 1466 feet; for a three-minute time response, the distance between boxes will be 2200 feet; and for a four-minute time response, 4000 feet. Such an extreme distance as 4000 feet is not of much practical value except where existing conditions make it unnecessary to place boxes closer together. For example, this spacing can be used in the outskirts of a municipality, particularly where motorized patrol is employed.

The foregoing calculations are of course more or less arbitrary and, when used in actually planning a beat-telephone installation, will be found more or less difficult to reconcile with the actual distances between street intersections. If, however, the figures suggested are used as maximum units of distance, there should be no difficulty in planning a layout.

It must also be remembered that the effectiveness of each call-box location is determined to a large degree by its relationship to the surrounding call boxes. In other words, each beat telephone becomes the center of a surrounding group of telephones. On some beats it may be necessary to eliminate or relocate a telephone at an otherwise desirable point, because of this relationship. Attention must also be given to the location of telephone boxes on the borderline between beats, in order to permit of maximum usage of the equipment at those points. Box locations should, as a rule, be made on or near the corners of intersecting streets, for the equipment is thus made available in both directions on each of two streets.

To determine approximately the number of beat telephones that may be required in a given police area, the following simple rule can be used, provided the total street mileage within the limits of the district is known. If the community or district requires a telephone distribution of varying density, as is the general rule, the intermediate time response of three minutes can be used. This element in terms of feet gives

an average distance between telephones of 2200 feet. Inasmuch as each box is, on the average, available in both directions on each of two streets, the approximate number required will be one-fourth of the street mileage divided by 2200. If the density of box distribution is to be uniform throughout the area, this result must be increased by about one-fifth. Street mileage traversing undeveloped areas may be eliminated. This result must be tempered by considerations previously discussed, since cognizance is to be taken of the concentration of crime in various sections, as indicated by the geographic origin of offenses and a survey of potential emergencies. Only by mapping out the territory in question, plotting the emergencies that may arise therein, and planning the shortest and fastest concentration possible, can an efficient and economical distribution of beat telephone equipment be made.

Experience has demonstrated that the usual police department, large or small, can profitably apply this plan at five-year intervals to existing beat-telephone facilities so as to determine whether or not the present location and distribution of equipment is economical and effective and what changes, if any, should be made to increase patrol efficiency. There are many examples of beats, formerly star contributors to the sum total of a city's crime, that have drifted suddenly into the doldrums of criminal inactivity and become peaceful and respectable neighborhoods. On the contrary, some quiet business section may become a huge manufacturing area. From a once quiet, rather out-of-the-way place, another will be converted into a "roaring third." Our social life and organization is in a constant state of flux. Changing population density and nationality, shifting business areas, changes in the character of suburban residential districts, the appearance of new hotels, banks, theaters, jewelry stores and other mercantile establishments, may, in the course of a five-year interval, make the communication facilities of one beat obsolete and inadequate, while other beats may have become over-equipped.

The growing motorization of police service introduces a new element into the problem of distribution. Recent police surveys indicate that approximately nine-tenths of all police departments in the United States now make use of the motor vehicle to a greater or less degree.[3] If the area is to be patrolled exclusively by automobile, it is possible to maintain the two-, three-, and four-minute time-response intervals with box distances of 4693 feet, 7040 feet, and 9386 feet, respectively, assuming an *average* speed of 20 miles an hour in answering the call. However, experience is proving that the remarkable efficiency of the automobile in beat patrol work is increased as the density of telephone boxes approaches the standard density set for foot patrolmen.

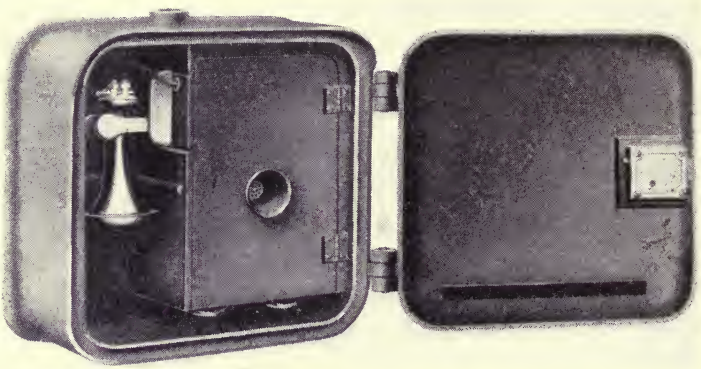
The actual installation of beat telephone units may be done under the supervision of the company that supplies the equipment. Often, the municipal electrician, who is usually fully competent to do it, may make the installation. Irrespective of the type of unit employed, an independent pair of wires must connect each telephone to the station terminal equipment; otherwise, where a number of units are connected on the same circuit, one telephone out of order means that all telephones on the circuit are disabled, occasionally paralyzing communication over an entire beat. The so-called series plan of wiring police-box telephones is being rapidly superseded by installations in which each telephone may become defective without affecting the rest of the equipment. There is also the additional advantage that the source of the line trouble is more easily found.

The telephone units may be mounted on individual metal standards anchored in a concrete foundation, or, if a less expensive installation is desirable, they may be mounted on or against any permanent or stationary object, such as a brick wall or telephone pole. In many cities, police boxes and fire boxes are mounted on a common standard, but the advisability of this arrangement, except in special situations, is

[3] Study of 480 cities of more than 5000 population in the United States made by the author.

open to some question, since the distribution of fire boxes may not coincide with the plan worked out for the location and distribution of the police equipment. All fire hazards are police hazards, but the converse is not exactly true, and it is probable that there would be a conflict in the arrangements if an attempt were made to locate the police equipment to the best advantage.

The housing box varies in dimensions within a small range, usually being approximately 12 inches wide, 16 inches long, and from 8 to 10 inches deep. In order to expedite the work



Beat telephone equipment. Box can be mounted at any convenient location.

of the patrolman, some departments are giving attention to the design of the telephone unit and its housing. The so-called hand-set telephone unit is proving its worth as the instrument best suited for this type of work, since it affords a greater freedom of movement at the telephone and gives the officer a better opportunity to take in writing such notes and information as may be necessary. Furthermore, there may be installed within the structure a small folding shelf or platform which comes to rest in the writing position when the door is opened. To facilitate writing at the telephone in the nighttime, a small electric bulb may be placed at a convenient point inside the

box, with contacts and circuit arranged so that it is in operation only during the time that the door is open.

The problem of how and where to install the beat telephone, however, is not a new one, and old solutions are still in vogue today. The patrol booth, for example, is an adaptation of the fixed post in military tactics and strategy. The fixed post is to be found in the patrol plan of the earliest European police departments, where, because permanence was desired for it, it became a more elaborate structure than would have been feasible for military purposes. Its introduction into the United States followed as a matter of course.

In modern times the booth still holds an important position in the decentralization plan of some European police systems, although in some places its use and operation has been modified to meet changed conditions. In England, Chief Constable Crawley of Newcastle-upon-Tyne, on January 29, 1928, presented a report in which he outlined a plan of reorganization based upon the use of the patrol booth as the center of communication and activities on each beat, supplemented by the installation of telephone boxes (i.e., booths) at half-mile intervals throughout the area.

These telephone boxes or booths situated at strategic points throughout the area were, in fact, miniature police stations. They afforded temporary shelter for two or more persons, had limited cell accommodations, and were equipped with telephone connections direct to the station which controlled their activities. Crawley modified the fixed-post system and outlined a plan of patrol similar in many respects to the best American practice. The present London metropolitan beat telephone system also makes use of patrol booths, but differs from the system developed by Crawley in two important respects: it provides for not more than one telephone booth on each beat; and the booth is a fixed post in the true sense of the phrase, as an officer remains on duty constantly at each booth. He is charged with the immediate supervision of the constables who actually patrol the area. In this system, the patrol booth is a veritable police substation, equipped with telephone,

stool, small cupboard, desk and drawer, box diary, first-aid outfit, fire extinguisher, electric heater, brush, duster, breakdown card, portfolio for miscellaneous circulation, forms for dealing with or describing property lost or found, and missing persons, and other police record forms. Encouragement is given to the use of the booth telephone by the general public, the instrument being made accessible to them upon their opening a small, unfastened, cupboard-like door.

The conditions that indicate the use of the patrol booth abroad are somewhat different in this country, and American police departments that adopted the booth system have long since left it by the wayside. There are still, however, some persons who believe that this type of equipment, under certain conditions, can be used effectively in modern patrol operations. As late as 1918, the Detroit Police Department decided, after an experimental installation, to erect thirteen additional patrol booths. The problems which confronted Detroit were common to most large cities. By 1918 the total area of the community had expanded to 80.86 square miles. Because of the unprecedented growth of the city, together with the annexation of new territory, the department faced the serious problem of providing adequate police protection for all the newly acquired, outlying districts. Obviously, in such areas the beats would have to be exceedingly large or the cost of patrolling them would be more than the city could afford to pay. The chief need was decided to be an arrangement by which a policeman could be called quickly in an emergency, and the solution found was the patrol booth.

The booths were centrally located in outlying districts, and were supplied with telephone facilities for both police and public use, and connected by direct telephone wire to the station. A policeman equipped with a motorcycle or automobile was assigned to each booth on a fixed post, and another officer was detailed to each booth but patrolled between this fixed post and the next booth in adjacent territory. This procedure permitted the patrolmen to work in relays, there being at all times one officer on patrol and a man at the booth.

The booth system appeared to give rather promising results both in Detroit and in New York, where Colonel Woods had, prior to this time, supervised a similar installation and found it well adapted to the needs of suburban districts. It was asserted that the time required for a patrolman to reach certain points had been reduced from forty-five minutes to from six to eight minutes.

Whatever may have been the value of the patrol booth in meeting police requirements in noncongested residential districts, the expanding use of communication on the beat has eliminated it as a fixture in American police service, and with it has gone the old fixed post. The booth system was based upon the availability of police strength in the immediate vicinity of each booth and it attained that end by the detailing of men to fixed posts where they would be available on call. It represented but a slight advance upon the old reserve system in which a body of men was kept in readiness at headquarters for emergency calls. In fact, it was the old reserve system under another name, for it involved the retirement of a certain percentage of the force from active beat patrol work, and a corresponding impairment of the crime-preventive function of the police. In the smaller communities, the recall and beat telephone systems together are answering the problem of availability and at the same time are permitting the officer to patrol his beat as a crime deterrent. In cities where there is radio control of the patrol force, there is of course no problem of availability.

With modern beat telephone equipment, the patrolling of the beat can be varied and improved upon in a number of ways, and a greater amount of protection thus secured. By properly arranging the schedule of boxes to be pulled and the time limit allowed for pulling each box, a definite patrol plan can be developed that will ensure the patrolman's reaching all parts of his beat as frequently as the size of the beat and his period of service allow. The patrolman on the smaller beat will naturally be able to cover his territory more frequently. The important point is to arrange the schedule so as to meet

the requirements of each individual beat so far as the general plan of operation will permit.

With respect to beat telephone density, a number of alternate schedules should be possible for each beat. There is a natural tendency for anyone repeatedly traveling between two points to follow a definite route with more or less consistency until it becomes a habit. Patrolmen so frequently acquire this habit that criminals are often able to time their operations so that the possibility of detection is greatly lessened. The English place great emphasis on the element of surprise in patrol operations. In both London and Newcastle-upon-Tyne the reporting-in time schedules are changed at frequent intervals and officers are instructed to avoid regular routes of travel in touring their beats. Every effort is made to mislead the public so far as their movements are concerned. In this respect, American patrol practice may be improved.

The ringing-in schedule of patrolmen should be rigidly observed, although it is generally understood that police duty is not to be neglected in order to conform to the schedule. A variation of from five to ten minutes from the scheduled time of reporting can be tolerated if this does not happen repeatedly. Where the delay in reporting-in exceeds thirty minutes, an immediate investigation should be started by the station commanding officer, since the officer concerned may be badly in need of some sort of assistance. At the station, a regular record form is kept on which beat telephone calls are recorded, indicating as a rule the name of the officer calling, the number of the call box used, and the time of the call. The operator has a list of all call boxes with their corresponding locations, so that when necessary this information may be referred to without delay.

The beat telephone has hardly begun to demonstrate its possibilities in police work. Careful study of its flexibility as a means of communication between the beat and the station will undoubtedly discover new uses, and future improvements in patrol service will be contingent, in large measure, upon such developments.

Estimates covering the cost of beat telephone apparatus and its maintenance may be obtained by police authorities from the companies distributing this type of equipment. Where the equipment is installed by the local telephone company, it is usually supplied and maintained by the company at rates applying to the ordinary off-premises extension service, plus an additional rental for the special equipment. This rental is usually calculated on a mileage basis. Where cities own and operate their own apparatus, the sets may be bought outright. The cost of privately owned and maintained beat telephone equipment varies with different localities, depending upon the initial cost of the equipment and the cost of installation and maintenance. In a number of cities, the arrangement described above has been found most economical, that is, where the telephone lines and instruments are rented from local telephone companies and maintained by them. Communication engineers associated with these companies are always available for consultation.

THE POLICE RECALL SYSTEM

The modern recall system is aptly illustrated by the Jersey City installation. To aid in the spreading of alarms in the event of the commission of a major offense, or in the speedy mobilization of the department in an emergency, each precinct in the city is equipped with red-light alarm signals, installed by electricians of the department. These signal devices are strategically placed and are immediately visible to every policeman in the vicinity, whether on or off duty, all members of the department being required to answer the silent but peremptory summons by communicating with the precinct by call box or private telephone. Following the completion of the system, the then Director of Public Safety Quinn said: "I consider [it] one of the most valuable adjuncts to the mechanical contrivances in use to prevent and detect crime." To make the system yet more nearly complete, Jersey City has created an emergency battalion, properly equipped and capable of coping with any situation that may

arise, such as large conflagrations, riots, and other emergencies.

All recall or signaling systems consist essentially of a centrally located control or transmiting mechanism from which electrical circuit lines radiate to designated points in the area served, actuating audible or visual signal devices capable of attracting the attention of officers in the field. The system may comprise elaborate control apparatus capable of providing automatically fifty or more different code-signal combinations, or it may consist of a simple switch operated by the local telephone operator in a small community where a lone patrolman goes on his appointed rounds. Fundamentally, the recall signal is a visual or audible notification to the patrol officer to telephone his station for instructions.

With the variety of electrical equipment now available, it is a simple matter to devise a signal code sufficiently flexible to meet all ordinary situations in indicating what officer or groups of officers should communicate with the station. The accompanying list of code combinations in use by one department illustrates the possibilities in this direction:

CODE COMBINATIONS

Steady light	All officers (emergency signal).
Steady alternated with 2	Cover bridges as instructed by precinct commander.
8	Special details.
21	Sergeant in district.
23	Captain or lieutenant.
24	Prowl or shotgun squad.
25	Patrol wagon and ambulance (while out on call).
26	Open for special signal as desired.
3	Plain-clothes division (vice squad).
31	All inspectors.
32	Auto-theft division.
34	Crime-prevention officers.
4	All traffic officers.
41	All foot-traffic officers.
42	All motorcycle-traffic officers.
5	Chief or assistant.

In addition, different and specific signals are assigned to the individual beat patrolmen, so that these members of the patrol force may be available for immediate service in matters which involve only a particular beat. Signals will flash thus: 23 will flash ** *** ** ***; 31 will flash *** * *** *; 4 will flash **** **** ****. Signals are always repeated until answered.

When a certain patrolman is wanted, a signal corresponding to his beat or call number is transmitted over the circuit which controls recall-signal devices in his district. In response, the officer hastens to the nearest call box, and calls his station. He answers to no other signal except the emergency call for all officers, and no other officer responds to this officer's number.

In emergency situations, when it is desirable or necessary to disseminate orders and information to all members of the force on duty, a general call signal is sent out over all circuits, thus operating recall equipment in every section of the city. To this general emergency call all officers respond, and as they answer by telephone over the various police-box circuits, the necessary instructions are given them. This call may be made more effective, as in Jersey City, by requiring that all off-duty officers who happen to observe the emergency signal must report to their station from the nearest telephone. In such circumstances it frequently happens that two or more officers may report in at approximately the same time, and it is then possible to give the information to all of them simultaneously. There are also occasions when a call for police assistance or investigation may involve two or more beats, or perhaps a section of the city, to the exclusion of the others, and circuit controls can be arranged so as to operate signals only in the area affected.

DESIGN AND INSTALLATION OF RECALL SYSTEMS

Practically speaking, the production of a satisfactory signal on the beat which will attract the attention of the officer on patrol is limited to those devices which give an audible or

visual signal. Experimental work is now being conducted on the possibilities of the use of infrared light in police signaling, because it seems to promise secrecy and other advantages of such transmission. At the present stage of development, the reception of this type of signal by the officer would require a specially designed detector, somewhat similar to the conventional radio receiver. Successful adaptation of invisible light for use in alarm systems suggests that further experimental work in this direction may produce a practical device for field signaling purposes.

For several reasons the audible signal has been in large part supplanted in modern police service by the visual, or light-signal devices. Aside from the fact that the human ear is insensible to sound frequencies below 8 or above 32,000 a second, the penetrating power of sound waves is very definitely limited in its transmission by both acoustical and meteorological factors. Presence of large objects, such as buildings, obstructs the normal advance of sound waves; atmospheric conditions, wind velocity, temperature variations, and other similar factors raise or depress the audible horizon of a given source of sound, and thus lessen the dependability of the sound-signal device. Further, in accordance with the law that sound intensity varies inversely as the square of the distance from its source, the sound signal that would be effective as a patrol recall device would also most undesirably arrest the attention of everyone else in the area; yet if it were of less intensity, so as to require the officer to remain within earshot, this necessity would greatly hamper free patrol movement. If the officer patrols his beat properly, experience shows that he is usually out of range of communication by ear when emergency arises. Modern police departments are therefore depending more and more upon the light signal as a solution of the recall problem, since it is silent in operation and capable of efficient transmission over any ordinary distance.

Both experiment and experience dictate the use of red as the color of the light signal. Study has been made of the relative effectiveness of various colored lights in signaling by the

United States Bureau of Lighthouses, in an attempt to use other colors, but none was so effective as red. It has been found that, in order to produce some other color which at the proper distance could be identified unmistakably, the intensity of the beam would be feeble in comparison to the light source employed. For instance, in order to produce a violet distinctive from red on the one hand and from blue on the other, the necessary density of the color screen cuts down the beam candlepower to not more than one-tenth of that obtained with white light. White light is unsuitable for police signaling purposes because it is easily confused with other light sources at night, and because it is so little visible by day. Green is fairly effective as a signal color, but loses most of its effectiveness under daylight conditions. Red is generally selected because of its high contrast and arresting power both by day and by night, when properly controlled. It is significant, in this connection, that red is employed as the "Stop" signal in most of the automatic traffic control systems.

Given a suitable color in the design and installation of recall systems, there still remains the problem of visibility, the proper control of the light source. There is no intention or desire to illuminate any surface or surrounding object, all effort being bent toward increasing the visibility of the source of the emitted light; and in the recall light-signal unit, the object of vision is the light source itself. A horizontal light-distribution pattern is therefore desirable, with maximum distribution in four directions 45 degrees apart, since recall signal units are installed whenever possible at street intersections so that they may be visible from the maximum number of directions.

The refractor used for police signaling is known as the four-way or four-beam refractor. This concentrates the light not only in a beam which makes it visible from maximum distances, but also further conserves the light so that the beams are concentrated up and down the intersecting streets in all four directions. With the lamp at normal focus within the refractor, a beam is produced which makes an angle of 75

degrees with a vertical line drawn directly below the center of the unit. It is possible, however, to adjust the filament positions vertically within the refractor so that five or more degrees may be added or subtracted from this spread; this makes for maximum efficiency and coverage through field adjustment when the installation is made. In the police signal

Police recall-signal unit for mounting at street intersections. Note dark shade and shadow area for illumination contrast.

refractor, the outer half of the unit is of ruby glass in order that a uniform red signal may be seen, day or night. Diffusion of light, as in street-lighting projects, is neither necessary nor desirable in the police-signal unit. Tests, supplemented by experience, have indicated that a 300-watt lamp mounted in this type of refractor unit will provide a uniformly efficient signal under all ordinary conditions.

Although the unit described represents the standard recall-light signal in use by the more modern departments, improvement is expected to follow the developments in scientific control of light sources. Some attention, for example, is being

given to the possibilities of a revolving unit, similar in principle to lighthouse apparatus, in which all the emitted light is concentrated in one direction through the use of the reflector and lens. This of course materially increases the range and effectiveness of a given source of light. The approximate range of color light signals employing the reflector and lens is shown in the list of ratings used by railroad signal engineers:

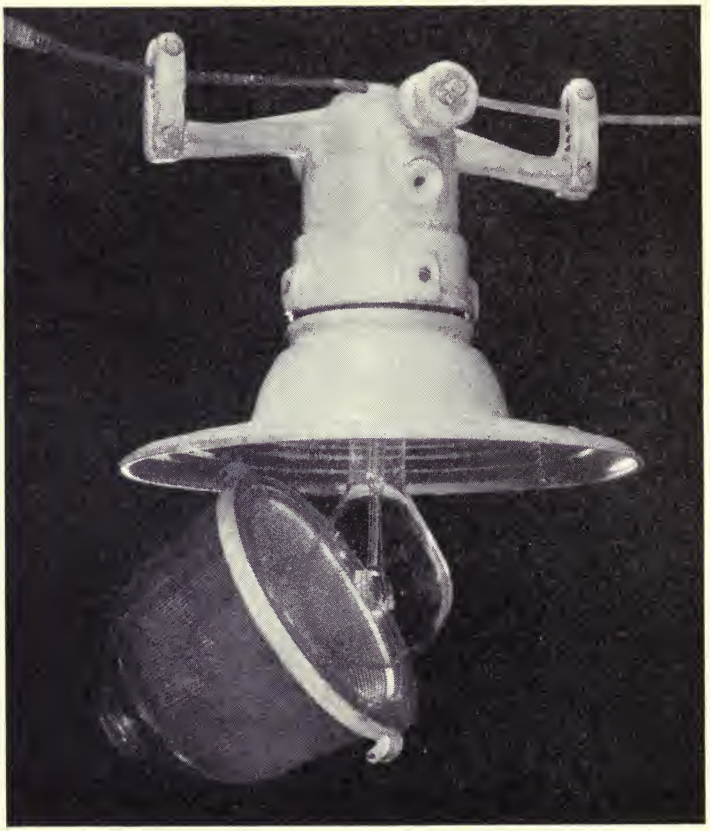
LAMP RATINGS

Volts	Watts	Approximate range of signal (ft.)
10	40	5,000 to 6,000
10	18	4,000 to 5,000
8	18	4,000 to 5,000
8	10	2,500 to 3,500
120	30	4,000 to 5,000

Range as applied in the list of ratings is based on the use of a lens 8⅜ inches in diameter, and is the distance on a tangent, in bright sunlight, at which the signals are clear and distinct to a person of normal eyesight. Such a unit, however, involves the use of equipment in which the unit itself, or some part thereof, revolves—a circumstance which has thus far prevented the design of practical apparatus for police signal purposes. Continued experiment will undoubtedly make this revolving unit available for police use.

In the location and distribution of recall signal units, visibility is of primary consideration. Because of the many variables which affect the visual characteristics of these signals, it is difficult to set up an exact rule for their distribution. Visual characteristics of the respective streets must be studied. At night the police signal is constantly competing with other strong sources of light, such as advertising signs, particularly in business areas. Obviously, the effect of these is to reduce the contrast and the arresting power of the recall signal. Standard street-lighting equipment is not necessarily a competitor. Minimum lighting intensities required to make streets

by night essentially as safe and convenient as by day have been determined by illumination engineers and these data usually govern the installation of street lighting equipment in modern cities. Nevertheless, the strong sources of light



Another police recall-signal unit: a span-wire suspension unit equipped with bowl refractor; refractor lowered.

necessary for good illumination interfere, of course, with the visibility of the red-light signal. In order to minimize this difficulty, wherever it is practical to do so, the signal unit should be isolated at some distance from street lights. By day,

the situation is more serious. At noontime in most California cities, for example, the sun produces during midsummer fully 10,000 foot-candles of light. To meet this competition, every advantage must be taken in the location of the light unit. Actual experiments should be made on each beat under both nighttime and daylight conditions in order to determine the most practical distances over which a typical signal unit may be considered observable by the patrolman. Such a survey will reveal the existence of obstructions, such as trees and buildings, which interfere with the line of vision. Occasionlly, jogging streets must be taken into account.

Ordinarily, the unit described will be found to be effective under daylight conditions at a minimum distance of four average blocks in four directions, which means that signal units should be placed at approximately eight-block intervals. The existence of so many variables in problems of illumination will cause this estimate to vary both ways to meet local conditions, the location of each light being a separate and independent problem. In congested business areas where large buildings and other structures impede vision, signal-unit density will be somewhat greater than the foregoing figure, which is given only as an average distance.

For best results, recall units are mounted at from twenty-five to thirty feet above the center of the street intersection. The higher the signal the greater the visibility, but with the greater use of the automobile in patrol work the effective height is restricted, as the visor and top of the car may obscure the signal for too great a distance. In most communities there are certain points strategically placed, such as buildings, towers, and other structures, from which a signal would be visible over a comparatively great distance, thus permitting the patrolmen of two or more beats to see the light from any point in their respective districts. In Berkeley, Calif., the hills on the eastern outskirts of the city presented an opportunity of this kind and the installation of a signal unit on an elevated point has given excellent results. In engineering the recall system, however, it should be remembered that it

is not necessary that the patrolman be able to see a signal light from any given point on his beat. Since he is constantly moving about the area, either on foot or in an automobile, an approximate eight-block interval between units would bring a light into his line of vision in from one to two minutes. Where foot patrolmen are used exclusively on the beat in outlying districts, light-unit density may profitably be increased. In no circumstances should the interval of vision exceed two minutes.

The old practice of mounting the recall-light unit on the call box so seriously obstructs the line of vision as to eliminate any usefulness that the unit might have when so placed. This type of installation is still found in some cities, but the best practice is to suspend the light with span lines over the center of the street intersection. This is both economical and convenient, and permits of the unit's being lowered or drawn in for replacement of parts or for cleaning.

The application of electricity to the uses of daily life has resulted in recent years in the manufacture of equipment specifically designed by electrical engineers for the police-recall system. A complete electrical recall system is now available as an independent installation. A number of manufacturers, both here and abroad, combine the recall signal and telephone unit as one composite installation. In most of these installations, the recall unit, consisting of a light, bell, or horn, or some variation of the semaphore method of signaling, is mounted directly on the telephone housing.

Where conditions dictate the use of a sound signal, vibrating or motor-driven horns are most serviceable, as they deliver a very loud and penetrating note, which can be heard over comparatively great distances. Of all sound-signaling devices, however, the siren and large whistle are probably the most effective. This type of signal, however, except for the use of the siren on fire and police department vehicles, should be reserved for general city-wide alarms, as, for example, a major emergency or a disaster.

The cost of recall installations varies with the type and

elaborateness of the equipment selected. For a paltry sum the small community might install a Mazda bulb at some high central point for signaling to the patrol force. Connected to a suitable push button or switch at the point where calls for police assistance come in, this inexpensive device would make possible a service out of all proportion to its cost. Other communities have installed light units at strategic points in an area where twenty-four-hour telephone service is provided, such as fire houses, bridges, pumping stations, telephone exchanges, elevated railway stations, surface carbarns, and milk depots. To have a signal given in a designated district, one needs only to telephone the agency at the proper point and request that the signal be turned on. Such a system affords a very economical service, as it eliminates the necessity for a circuit network connecting the station control apparatus with the signal units. The cost of a standard recall system, however, is easily within the means of most police departments, and the purchase of standard equipment soon justifies its original cost in the greater effectiveness of the individual officer and of the department as a whole.

The police department of Glendale, Calif., recently faced a situation common to a large number of cities in this country. This community covers an area of approximately 20 square miles and has a population of from 70,000 to 75,000. Until quite recently, the public telephones were the sole means of communication between the police station and outlying patrol forces. The police chief (John D. Fraser) obtained estimates covering a composite system of beat communication which combined the telephone and recall units. The figures ranged from $75,000 to $100,000 with an estimated annual maintenance cost of from $6000 to $8000, the usual amount with some composite systems. Such an expenditure would have been in the nature of an extravagance. Furthermore, a bond issue would have been required, and between the citizens who are always too indifferent to vote and those who are unalterably opposed to bond issues in general, the project would have been defeated.

After thorough investigation and discussion, Chief Fraser finally purchased the Rae recall system, and entered into a contract with the local telephone company for telephone service, this service including the installation of a PBX telephone switchboard at headquarters and thirty-six beat telephone units distributed throughout the city. The Rae recall system, by means of which the station operator is able to flash a signal to any officer or group of officers on the beat, was installed by the city electrician. The amount of current consumed is small, and the monthly maintenance cost is less than $25. The total cost of the combined installation, including the recall system and the iron boxes in which the telephones were placed, was less than $8500. The monthly rental for the switchboard and thirty-six telephones, based on the wire mileage, was of course much less than the estimated monthly maintenance cost of the composite system.

Recent improvements in land wire transmission include the introduction of the multifold carrier current control system, which may influence future installations of beat telephone and recall equipment. This unique system of transmission is significant in that it utilizes existing wire networks of the power and telephone companies and eliminates the cost represented by the purchase or lease of the land wire connections ordinarily required. Through an independent carrier frequency imposed upon these commercial lines, communication may be had with any desired point in the area so covered. If a transmitting device generating a frequency of 2000 cycles, for example, is coupled in a suitable manner to a 60-cycle network, 2000-cycle signals can be superimposed on the lower frequency without in any way causing interference with the 60-cycle current; likewise, the lower frequency has no effect upon the 2000-cycle system. The 2000-cycle impulses of the carrier current travel out from the transmitter over the primary feeders, through the distributing transformers, to the secondary circuits and therefore throughout the commercial network. Transmission of signals is thus accomplished by the use of varied frequencies, relayed from the central trans-

mitter to the power or telephone lines. These frequencies affect properly tuned receiving sets, which are connected by means of an ordinary plug inserted in the commercial lighting or telephone circuit. When resonance is established between the transmitted frequency and the receiver, the receiver, in accordance with its pre-fixed adjustment, rings a bell, lights a light, or performs some other operation.

By means of this system, transmission may be made over lines which have failed because of grounds, broken or short circuits, or any of the usual troubles of the ordinary electric circuit. Tests have indicated that alarm signals may be radiated in various directions from a central point over distances of from 200 to 300 miles. Furthermore, by the separate generation of two or more carrier frequencies, a number of different communications or signals may be transmitted over the same line simultaneously. The system accommodates voice transmission if carrier frequencies of from 60,000 to 100,000 cycles are employed.

The application of this new development to the beat communication system, particularly to the recall, must be obvious. Recall lights with relays can be installed anywhere and in as great number as desired, the actual current for the lights being taken from the 110-volt 60-cycle circuit, and the controlled carrier frequency riding the same circuit operates the relay and causes the desired signal to flash.

How to reach off-duty patrolmen in an emergency has always been a serious problem. Even where officers have telephones in their homes, valuable time is lost in the cumbersome process of summoning them to the station by individual telephone calls. Through the facilities of the system here under discussion, the problem is reduced to its simplest terms. It is only necessary to connect a receiving element to a light socket in the home of each officer and the station may signal him at will. If he moves to another house or apartment, he takes the unit with him. There are no wires to transfer and the equipment is moved in much the same manner as the ordinary household radio receiver.

With its adaptability to two-way voice communication, the multifold carrier current control system should find a ready application to the engineering problems of the beat telephone system. Elimination of the cost of land wire connections will liberate funds for the purchase of additional telephone units for installation on the beat. Thus far, public utility companies are said to be quite willing that their lines shall be used for police and fire-alarm purposes, since the transmission of messages and signals does not interfere in any way with the normal services provided by their circuits. In individual installations, it would of course be necessary to obtain the consent of the local company whose facilities it is desired to use.

The discussion and data presented in this chapter enable us to reach the conclusion that beat communication equipment now available can give to any police organization installing it all the essential service required to meet present-day needs in police work, and further, that such equipment can be had at a cost well within the means of all municipalities, regardless of size.

Chapter IV

THE POLICE RADIO SYSTEM

The introduction of the automobile into modern patrol service made mobilization a factual possibility. One of the major developments of the present decade in police service, the automobile patrol is rapidly displacing foot patrolmen in residential and semiresidential sections, and supplementing the work of foot patrolmen in business districts. One man in an automobile can do routine work as effectively as two or more foot patrolmen, and in emergencies he can do more than a dozen unmounted policemen. Virtual extinction of the "flat-foot" or foot patrolman is inevitable; a 250-pound policeman walking his beat, equipped with a revolver but slightly improved over the model that subdued the West, can no longer be expected to cope successfully with criminals in fast motor cars and armed with modern weapons.

The fundamental strategic value of the automobile was its conversion of a static patrol force into a mobile group, capable of rapid movement from one point to another. The automobile solved also a tactical problem: it increased very greatly the range and value of the individual patrolman. A second tactical problem, however, that of effectively conserving the reserve strength of the department, was still in large part unsolved. The beat communication system with its telephones and recall signal lights was a step toward solution, but it limited the rapidity of mobilization—a vital factor in the fighting strength of a combat unit.

The limitations it imposed are best illustrated by data obtained from studies conducted in one police department to determine the actual time interval of response to recall-light signals. The results indicated that, under ideal conditions, contact may be established with the beat patrolman in an average time of approximately 3 minutes and 57 seconds. The efficiency of the experimenting system was, however, far above the average for most police departments, and the values

given accordingly represent the best performance obtainable with this equipment under actual operating conditions. Between 8:00 A.M. and 4:00 P.M., the average time-response interval was 5 minutes, 3 seconds; between 4:00 P.M. and 12:00 midnight, 3 minutes, 35 seconds; and between 12:00 midnight and 8:00 A.M., 2 minutes, 57 seconds. These intervals were computed from the moment that the signal-control mechanism was set in motion at the station until the moment when the officer lifted the receiver from a beat telephone and reported in. Other lost time—for example, the actual time consumed by the desk operator in conveying the message or information, and the time lost by the patrolman in getting in and out of his car—is conservatively estimated at from one to two minutes, and further time is dissipated in other lost motions. In other words, from the moment the station is in possession of the report or information, a time interval averaging from 4 to 7 minutes or more must pass before the officer is under way to the scene of the emergency.

Under ordinary conditions, the offender finds in this period of free time his margin of safety; within this time interval, he may escape to a comfortable seclusion four or five miles from the scene at the moment that the officer on the beat is receiving the report of the crime, and loss or destruction of valuable evidence and the disappearance of material witnesses are frequently results of this delay. The situation is further complicated by the addition of time employed by the patrolman in traversing the distance from the telephone on the beat to the scene of the disturbance. It is seldom that the officer happens to be in the near vicinity.

The motorized patrol, although a mobile and flexible affair, had not yet (the reference is to the situation three paragraphs above) become sufficiently organized, nor—and this was the critical difficulty—had the problem of communication been sufficiently mastered, to permit of its effective operation as a unit. As a result, mobilization was too slow to be of much value in an emergency. But a new help was at hand.

The radio, together with the automobile, was to usher in a

new era in the fight of the police to protect society. Its value in the solution of the problem was indicated by two of the physical characteristics of radio communication; namely:

(1) The energy emitted by a radio transmitter radiates to all points of the compass, and all receiving apparatus within range of the sending station can clearly receive its messages. Further, a message need be broadcast but the once, as it is received at one and the same time by all receiving stations within range.

(2) Of equal importance was the fact that communication could be had with the mobile units over any distance. An automobile, whether parked or moving at high speed, could intercept the message as well as the stationary receiver. Land wires were unnecessary: the ever-present ether was the transmitting medium. The only equipment needed was the sending and receiving terminals.

Thus, through the instrumentality of radio, headquarters was provided with a means for rapid communication with the deployed mobile patrol units. The decentralized force could be called into action almost simultaneously with the receipt of the report at headquarters. The time interval of response was reduced to zero and the outlying patrols could be informed at once of any request for police assistance. Rapidity of operation became an accomplished fact. The patrolman could traverse his beat on patrol and yet be available instantly, at all times, for emergency calls.

Most of the publicity that has been given to the police radio system deals with the spectacular split-second captures which it made possible, somewhat to the neglect of other points of value. Where radio communication is used, a fast, well-equipped fleet of cars is ready at any moment to deal with serious disturbances in any section of a city. There also fall to the lot of the police many routine duties which require, for their performance, men and cars. The radio patrol, while engaged in these activities, is always in possession of the latest information concerning stolen cars, holdup reports, descriptions of missing and wanted persons, and other crime information, and is always ready for emergency assignment.

THE DETROIT SYSTEM

Describing results achieved through radio communication in patrol service, Commissioner Rutledge, of the Detroit Police Department, addressing the International Association of Chiefs of Police at its 1929 convention, said: "Snaring criminals in a radio network, woven by broadcasting to radio-equipped cars, has become a matter of seconds. Seconds are precious to the lawbreaker. They spell the difference between escape and capture. The wider the margin of time, the better his chances to escape apprehension. With the use of radio communication between headquarters and the patrol cars we are catching the criminal red-handed. We are eliminating the introduction of circumstantial evidence in trials by indisputable proof of guilt. Economically, we are cutting down the cost of law enforcement . . . by synchronizing the arrest with the depredation and eliminating the need for long and costly investigations. Instead of trailing behind in the dust of the criminal, we are as nearly abreast of him as it is humanly possible to be."

The plan of operation in Detroit is typical of the present-day use of radio communication in police service. Information broadcast by the police transmitter is obtained from several sources and is of types which can be roughly classified as follows:

(1) *Runs.*—Orders to a police car to proceed to the scene of a crime, fire, or accident. The broadcasting of this type of information, generally known as a "run," is given precedence over all other broadcasts.

(2) *Station calls.*—Cars are often wanted by the precinct station, or perhaps by the police radio dispatcher. They are told to go to their station, or are given any other information that is necessary.

(3) *Teletypes.*—The Detroit Police Department uses the teletype system[1] for the dissemination of information from headquarters to its precinct stations. The radio station is equipped with one of these teletype machines, and teletype messages are broadcast by the operator. They contain information with respect to holdups, descriptions of men wanted by the police, reports of missing persons, and other information which is subject to broadcast.

[1] See Chapter VII, "The Police Teletype Network" (p. 242).

The transmitted information is obtained from two general sources: from citizens, by means of the commercial telephone system; and from the precinct stations and the several divisions of the Police Department. Lines from all possible sources of information converge into one room, where are both the central switchboard of the department and the dispatchers. These dispatchers, two in number, are trained men with long experience in their work. They, and no others, dispatch the police cars on runs. One of them supervises cars on the east side of the city, and the other the movement of patrol cars on the west side. They have available at their fingertips all the resources of the entire department. Patrol wagons, ambulances, detective-bureau flyers, emergency wagons, and other fast services can be obtained quickly by means of the police telephone system, and the radio-equipped scout cars and cruisers patrolling the streets of the city between the two dispatchers. They merely plug in on a telephone line to the radio station and the transmitting equipment is automatically, and almost instantaneously, in operation for immediate broadcast.[2]

In Detroit, as in many other large cities, the radio-equipped patrol cars are distributed by precincts. The regular police precinct is further decentralized into what are termed radio patrol districts, and a radio car is assigned to patrol each district. When an emergency arises, the car is dispatched to the scene of trouble. Patrol districts are determined systematically, with the following points in mind: (1) density of population; (2) the crime record of the particular territory; (3) the traffic problem—density of traffic, congested points, impediments such as railroads and topographical and other obstructions (obviously the traffic problem affects the speed of police cars and therefore the time required to respond); and (4) other police protection. The radio cars used are of two types, scout cars and cruisers. The scout cars are light machines. They are manned by two uniformed policemen and are assigned to definite patrol districts. The cruisers are heavy,

[2] See also "Communication System of the Los Angeles Police Department," in Chapter XII (p. 362).

The nerve center of the New York City police radio patrol system. The dispatcher is surrounded by maps of the city's boroughs which indicate by metal disks the location of all patrol cars on duty. Note, in background, transmitter at right, speech-input system at left.

high-powered cars, with bulletproof windshields. They carry four men, including two plain-clothes patrolmen, one driver in uniform, and one detective, and are equipped with riot guns, tear-gas bombs, and other emergency weapons. A cruiser patrols an entire precinct, covering territory assigned to patrol-district cars; thus, in the event of serious trouble, the two policemen in the scout car are supplemented by the cruiser crew.[3]

An incoming call for police assistance is routed into the main dispatching room. The operator receiving the call turns the information over to the police dispatcher. The latter ascertains from which precinct and district the call originates, then plugs in on the radio station and speaks into the microphone, giving the car number and a brief account of the report. As his voice goes out on the air, it is also audible to the operator at the radio station, who writes the message down and then signals the dispatcher, thus signifying that he has understood the message and that transmission has been accomplished. The radio operator listens to a loud-speaker which affords reproduction similar to that in the cars. After he has signaled the dispatcher, he switches connections to the microphone at the station and repeats the call in order to lessen the possibility that the car may fail to receive the broadcast.

The crew of the car designated in the broadcast, upon hearing its number called, listens to the immediately succeeding description of the "run," goes to the scene, and takes care of the trouble. As soon as the run is completed, the crew calls the radio station and reports back in service. Officers are instructed to call back at the earliest possible moment. Should the radio operator fail to hear from them within a reasonable time, another car is dispatched on the call.

RADIO: ITS APPLICATION TO POLICE USES

A radio message is a series of vibrations carried by wave motions through the ether. Frequency, or wave length, is all-important to message-sending, for it is this characteristic of

[3] See Chapter V, "Radio Patrol Operation" (p. 157).

radio transmission that permits the tuning or selection of the radiation of one station from that of another. Radio waves of a multitude of different frequencies are constantly crowding the ether. If it were not for strict adherence to the assigned frequency and the fact that each transmitted wave keeps its own frequency as it travels away from the sending station, without regard for other waves passing through space, radio communication could hardly be the practical matter that it is.

When a voice-transmitting station goes on the air, a carrier wave and two side bands are radiated from the antenna system. Although 60 per cent of the total power transmitted is in the carrier wave proper, it does not of itself carry the modulations. The side bands transport the speech and require a total width for a single broadcast channel of approximately 10 kilocycles. The fullest use of this crowded transmission medium requires the greatest possible constancy in the operating frequencies of radio transmitting stations.

This matter is of such great importance that it has been made the subject of special regulation by the Federal Communications Commission. In Section 2 of General Order 119, the Commission specifies "that no transmitter will be permitted to operate unless the applicant can show that the carrier frequency will be kept within 0.025 per cent of the assigned frequency by automatic frequency control." Recent Federal regulations require an adherence to the assigned frequency of plus or minus 50 cycles per second.

Because the number of frequency channels available for police operations is limited, the Commission has been compelled to regulate the power of individual police transmitting stations, in order to reduce interference and make possible a maximum number of police transmitters. The regulations are based upon the population of the area served. The maximum amount of power assigned for the use of stations is based on the latest Census Bureau population figures for cities or state subdivisions, as follows: population less than 100,000, 50 watts; 100,000 to 200,000, 100 watts; 200,000 to 300,000, 150 watts; 300,000 to 400,000, 200 watts; 400,000 to 500,000, 250

watts; 500,000 to 600,000, 300 watts; 600,000 to 700,000, 400 watts; more than 700,000, 500 watts.

Supplementing its regulations, the Commission says: "In the event that the amount of power allocated is insufficient to afford reliable coverage over the desired service area, the Commission will, upon proper showing being made, authorize the use of additional transmitters of duplicate power." Federal regulations require that in all circumstances except in the use of maritime distress signals, all radio stations, including those owned and operated by the United States, shall use the minimum power necessary to carry out the communication desired, and shall not exceed the power assigned to the station.

Since the power of a given police transmitter is fixed by specific Federal regulations, it is necessary to inquire concerning alternative means of transmission through which the service may be improved or the area covered, enlarged. There are several factors, more or less amenable to control, which if properly reckoned with will greatly aid transmission efficiency. Proper transmitter location is one of these.

The major importance of location is based upon some rather fundamental characteristics of radio transmission, some of which should be mentioned. To radio transmission there are three principal obstacles: (1) interference from other transmitting stations; (2) static; and (3) fading of signal strength.

Interference from other transmitters is controllable and can be eliminated if the equipment used is made to adhere strictly to a predetermined frequency.

Static is the term applied to electrical disturbances that give rise to irregular, interfering noises heard in the receiving apparatus. Some sources of static are accessible to man, and others—for example, lightning—are beyond his reach and necessitate the use of special apparatus. However, the recent improvement in the design of receiving apparatus has greatly mitigated the effects of this form of interference, and it is now of comparatively little importance in police transmission.

Fading or swinging of signal strength is an irregular or

regular variation of the received signal, given a constant circuit adjustment of both transmitter and receiver. This phenomenon is more prevalent on short wave lengths, particularly those of less than 400 meters, and is therefore of the utmost importance to the police. Early experimenters in the field of police radio are familiar with this troublesome characteristic of radio transmission, and even today police departments equipped with the finest radio apparatus occasionally encounter a fading of signal strength in certain sections of the area covered.

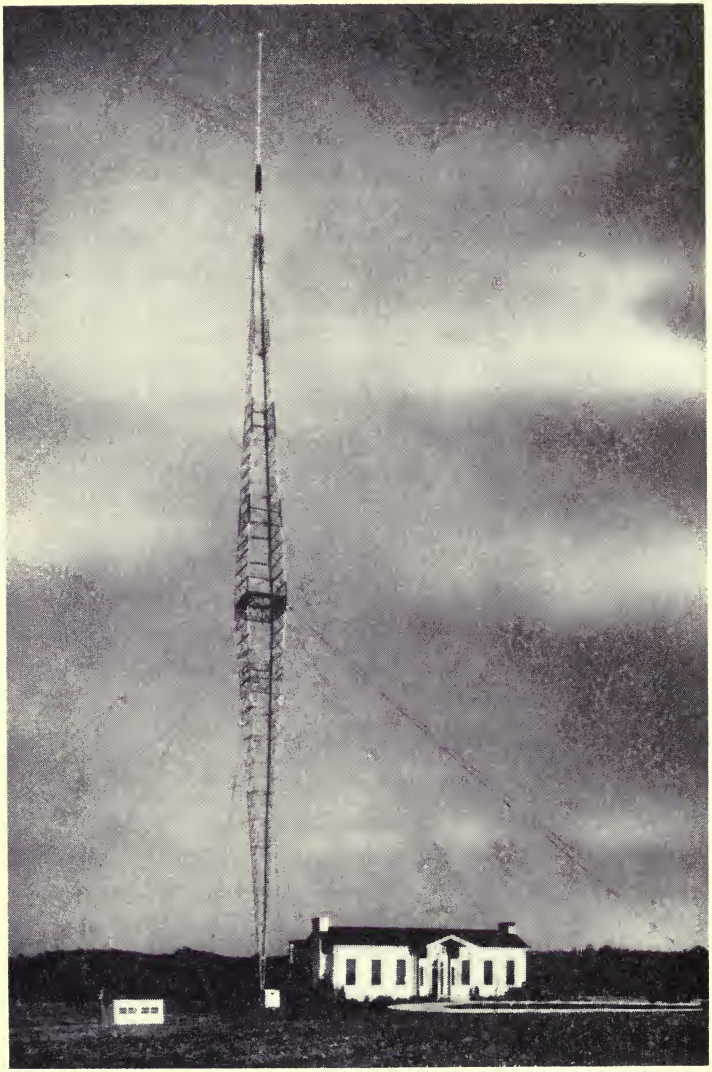
In the phenomenon of fading, the signal of a transmitting station will be received with normal intensity for a few minutes, and then for a brief interval the intensity will increase, and then it will so far decrease that the signal is too weak to be audible. Variations in signal strength may be very rapid, with a period of about one second, or very slow, with one-hour periods, and they usually occur where the transmission is over land areas. The causes of fading continue to be the subject of scientific investigation. Where fluctuations in the received signal are the result of variations in the wave length or in the intensity of the transmitted wave, as often happens, the situation is easily remedied by necessary adjustments at the transmitter.

Recent improvements in transmitter design and the application of greater transmitter power have done much to eliminate fading, particularly in the popular broadcast field. In the police field, however, the situation is somewhat different, by reason of two peculiar conditions. First, police transmitters are under the extraordinary limitations in power imposed by Federal regulations; the power of a police transmitting station may never exceed 500 watts. Second, a police receiving station is mobile, being installed in a patrol car that is constantly moving. The receiving apparatus is also subjected to many adverse conditions of interference peculiar to this type of installation, which will be discussed later. With these obstacles to be overcome, no possible advantage can be neglected.

It is generally accepted that the wave radiated from an

ordinary antenna spreads out in a hemispherical form, extending in every direction except into the earth. At a height of from 60 to 300 miles, this wave front reaches an ionized conducting region of the atmosphere known as the Kennelly-Heaviside layer, where it is reflected, somewhat as light is from a rather poor grade of mirror. A fading phenomenon known as phase distortion occurs when the wave reflected from the Heaviside layer reaches the receiving set simultaneously with the arrival of the "ground wave," or that part of the impulse which travels along the earth's surface. It will be perceived that when these two waves are applied to the amplifier tubes of the receiving set in the condition known as "in phase," an enormous increase in the signal strength will be apparent in the loud-speaker. Conversely, when the two waves are applied to the receiver 180° out of phase, the volume of the loud-speaker will be zero. The intermediate conditions as the waves drift in and out of phase—depending upon the strength of each individual wave—vary from zero to maximum. Elimination of either increases the apparent signal strength of the other, with little or no evidence of fading. It is for this reason that the vertical-style radiator antenna, which reduces the strength of the reflected wave, with a corresponding increase in that of the ground wave, is strongly recommended in police transmitter installations.

In radio transmission there is also encountered a phenomenon known as the skip-distance effect, which, until it was well understood, was more or less of a stumbling block. At a frequency of 16,000 kilocycles or a wave length of about 18 meters, the ground wave progresses outward only a few miles from the antenna when it is so seriously absorbed as to make reception difficult. The sky wave in the meantime mounts to the Heaviside layer, where it is reflected back to some point on the earth at a great distance away from the sending station. A simple study of the geometry of the situation will show that a wave leaving an antenna on the earth's surface and striking this reflector at an oblique angle about one hundred miles above the ground, must come down again in a remote region.



The ideal transmitting antenna.

There is therefore a region between the transmitter and the down-coming sky wave in which the transmitter is not heard except for very feeble echo signals. This curious ability of the short wave to skip over certain points within a radius of from 400 to 500 miles from the transmitter and yet be received with high efficiency by receivers 1000 to 2500 miles away, has a direct bearing on all radio transmission problems. In the early experiments with radio apparatus by the police in Berkeley, Calif., it occasionally happened that signals were booming away through the Panama Canal Zone which could not be heard at all in certain sections of the city.

From the foregoing, it will be apparent that all police radio transmission systems must depend upon the ground wave for their operation, since the police broadcast radius is comparatively short, usually less than seven miles if the transmitter is serving only the area comprising one large city. Frequently a centrally located transmitter serves police departments in two or more adjacent jurisdictions, but the service radius is seldom more than from fifteen to thirty or forty miles. Reception within a radius of fifty miles from a transmitting station is usually through ground-wave energy. But the ground wave clings close to the surface of the earth in its path forward, and its energy dissipates rapidly, on account of the exceedingly high rate of energy absorption by objects on the earth's surface. Moisture, dust, and sunlight absorb radio-frequency energy. On land, large conducting objects, such as buildings, wires, trees, mountains, underground metallic deposits and other electrical obstructions sap the energy of the transmitted signal. Skyscrapers and other large structures projecting into the air have a short-circuiting effect on transmitted energy. A formula has been derived for the strength of signals over salt water in the daytime, and the observed and calculated values are nearly always in fair agreement. Over land, however, observed values differ greatly from those calculated according to this formula, and vary greatly among themselves because of the difference in ground absorption in different sections.

If a copper wire ranging from 50 to 100 feet in length strung around the molding of a room can intercept sufficient energy from passing waves to produce sound which can be heard several hundred feet from a loud-speaker, it is not difficult to understand how absorption by trees, steel structures, electric wires, and pipes, may dissipate the strength of high-frequency radiation. A mountain, hill, or other irregularity in the earth's surface casts a radio shadow analogous to optical diffraction, and in the shadow area signal strength is at a low ebb. It is to the screening effect of hills and tall buildings, and the other obstacles mentioned that the occurence of the familiar "dead spot"—the enigma of all early experiments in police radio systems—may be attributed.

THE FIELD-INTENSITY SURVEY AND THE POLICE TRANSMITTER

An expert study by a competent radio engineer, taking into account all the factors and conditions pertaining to radio transmission within the area involved, should invariably precede the selection of the point at which the police transmitter is to be installed. It will require the attention of an expert technician, who has at his command the facilities of scientific laboratories and the sources of the latest engineering knowledge and information; the professional radio engineer has supplanted the "local genius," who played such an important and spectacular rôle in the early development of police radio communication.

The primary objective is to obtain satisfactory coverage at field strengths of sufficient intensity to produce good signals in a radio receiver mounted in an automobile, at any point within the policed territory. The most reliable and, in the long run, the most economical method of determining possible locations for the station, is by making scientific measurements of field-signal strengths with apparatus that has been especially designed for this purpose. A portable transmitter of not less than 50 watts power and possessing high operating efficiency is usually employed, for which a special license is issued by the Federal Communications Commission. This transmitter

should also be capable of maintaining as nearly as possible an absolute frequency constant. The transmitter having been installed at one of several possible locations, the test car, equipped with suitable signal-intensity measuring instruments, moves about the area to be served.

The strength of a radio-frequency field surrounding a transmitter in operation is defined in terms of "microvolts per meter." The field-strength measuring equipment is, in a sense, a radio receiver so designed as to give meter indications which can be resolved into microvolts-per-meter field intensity for each given location. With the portable transmitter rated at 50 watts output, the field-strength survey discloses the signal strength that prevails at given distances from the transmitter. The time of day and the season of the year are also noted, for, owing to natural causes, signal intensity may vary as between darkness and daylight and from season to season.

Upon completion of tests with the transmitter in a suggested location, it is next in order to plot signal-strength curves for the entire area. Data obtained from the survey are reduced to graphic terms by the preparation of a field-strength map. This map is so drawn that its center represents the location of the transmitter during one series of tests. As a rule, field-strength measurements are made by circling the transmitter at various distances. Several stops are made on each circuit and the field-signal strength at those points is noted. In drawing the field-strength map, the readings at these points establish locations or points on the drawing which need only to be connected by drawing contour lines bisecting them. Similar tests and procedure are followed through for each possible location of the transmitter. From these results the engineer may determine: (1) the most favored location for maximum coverage of the entire area; (2) the location of shadows, dead spots, and other fading areas which show a pronounced weakness of signal strength; (3) the location and identification of local sources of interference; (4) the type of transmitting antenna system best adapted to the purpose;

(5) the comparative signal variations by hour of day; (6) the variations between day and night signal intensity; (7) the efficiency of the location for transmitter grounding purposes; (8) the type and design of receiver best adapted to local conditions; and (9) the minimum transmitter power output necessary to cover the area efficiently.

From the field signal strength maps, department executives will be able to observe for themselves the results to be expected from the various locations. The radio-frequency input requirements of the automobile receiver being known, the effectiveness of each location tested can be determined by a glance at the map. From an engineer's point of view, the most desirable procedure is to select the transmitter location purely on the basis of the field-intensity survey. Where conditions are such that the most desirable location becomes unavailable, the purchaser will at least have, in advance, scientific evidence of the results that he may expect from the location selected.

In general, the transmitter should be at a point where good "ground" conditions prevail. Such conditions may not be found where, for example, the surface and underlying deposits are of volcanic origin, because of the natural nonconductivity of such material and its rapid drainage. Soil which has, on the contrary, a tendency to retain moisture, usually offers a good location so far as grounding requirements are concerned. It may develop, however, that natural or artificial shielding, absorbing, or reflecting objects may be interposed between what seems superficially to be a choice location and the area to be covered. Unfortunately, some municipalities are restricted to one or two possible locations. In such circumstances, the ingenuity and skill of an experienced radio engineer may be relied upon to indicate the design and installation of an antenna system which possesses the necessary characteristics. Adverse natural grounding facilities, it may be, may dictate the construction of a counterpoise for this purpose.

The most advantageous transmitter location as shown by the field-intensity survey might be at a point some distance from police headquarters, as in Los Angeles and a few other

cities where the radio communication equipment is several miles from headquarters. It is nevertheless desirable that the radio transmitter should be subject to control from the central police office. This can be accomplished by remote-control equipment.

In general, it is advisable to lease circuits from the local telephone company. Two circuit groups are necessary, one for starting and transmitting equipment, and the other for speech-input purposes. As a rule, the remote start-stop equipment consists of either a push button or a key arrangement. When the starting circuit is closed, the effect is as if the starting button on the transmitter had been pressed. This is true because the remote starting circuit is connected across the local starting circuit built into the transmitter. The best of remote-control equipment is now available, making this problem quite easy to solve.

For remote-control operation it may be necessary to amplify the signals between the microphone and the speech-input terminals of the radio transmitter, the amount of amplification depending upon the distance between the two points. The type of amplification can only be determined when the distance and impedances are known. Broadly speaking, what this amplifier should do is build up the current passed by the speech-input terminals at the transmitter so as to produce virtually complete modulation.

The field survey may reveal that one transmitter with its authorized power rating is incapable of covering the entire area effectively, particularly in the larger cities. The Federal Communications Commission has recognized this, and has indicated its willingness to authorize, where necessary, the use of additional transmitters of duplicate power and frequency. In an installation of two or more transmitters, separate field-intensity surveys will be helpful and perhaps even necessary in order to determine the best location for each piece of equipment. Transmitters are then usually operated as semi-independent units with remote-control lines wired direct to the central dispatching room at headquarters. Transmission sys-

tems of this type are now in operation in Chicago, where three transmitters are in use, and in Greater New York, where five are used to cover a huge area. In some installations where a plurality of transmitters was to be employed, an attempt was made to synchronize their operation. The Commission, however, considers this impracticable under present conditions and has not as yet approved any police request for permission to operate in this manner.

In cities equipped with radio communication facilities, great reliance is placed upon them, and much is required of them. This circumstance tends to increase the dangers involved in interruption of service; disabling of the transmitter, failure of power supply, damaged antenna system, or other causes which may temporarily throw the system out of service, place the patrol force at a serious disadvantage. A measure of control remains possible through the beat telephone and recall systems, but the longer time-response interval precludes the effective concentration in emergencies that has made the police radio indispensable. Adequate safeguards should therefore be provided to forestall such contingencies as far as possible; and experience has shown that, with proper precautions, this hazard may be reduced to a minimum.

When interruptions do occur, the immediate necessity of course is to make possible the resumption of operations with the least possible delay. A full supply of extra parts and equipment should be a first requirement in the inventory of every department using radio communication. Interruptions in service fall, as a rule, into three broad classes: (1) failure of power supply; (2) transmitter failure; and (3) faulty or damaged antenna system.

The power supply in a radio transmission system represents the source of electrical energy for driving its equipment, and any interruption of current or failure of power equipment results immediately in a complete shutdown in transmission. The various types of power-supplying equipment used in conjunction with vacuum-tube transmitters are the direct-current generator with suitable filters, alternating cur-

rent with transformer and tube rectifiers, storage batteries with suitable ampere-hour capacity, and alternating current with transformer but without tube rectifiers (raw alternating current). Of these five possible producers of transmitter power, the two first named are the most widely used. Several modern types of transmitter are equipped with transformer and rectification apparatus which transforms the coming line current to proper voltages and rectifies the alternating characteristics into a smooth pulsating current suitable for modulation purposes. Step-down transformers supply proper voltages for the tube filaments. Storage batteries with a sufficient combined strength may be used as a source of power supply. In fact, batteries supply the ideal current, but the enormous assembly of cells necessary for the high-plate voltages required in modern transmitters precludes their continuous use. A storage-battery assembly, however, with gasoline-driven charging equipment, is sometimes used as an auxiliary power supply.

The Chicago Police Department now has available for immediate operation three separate and independent power-supply installations. A number of other departments have installed complete auxiliary transmitters, which provide of course the most satisfactory form of insurance against transmitter breakdown. In such installations, provision for automatic throw-over from one transmitter to the other when breakdown occurs will eliminate the possibility of any delay. If economy is imperative, it is not absolutely necessary that the auxiliary equipment have the same power rating as the regular equipment nor need it be an elaborate affair, since it will only be used for very brief periods. The ideal auxiliary transmitting equipment would be an exact duplicate of the service transmitter. Some sort of reserve transmitter should be provided and it should be the very best obtainable within the local limitations. A medium-power transmitter for this purpose may be installed at a nominal cost. If even this is not possible, communication officers should acquaint themselves with all private transmitting equipment in the immediate

vicinity, including transmitters employed by commercial broadcasting companies and particularly the equipment in use by amateurs. Many amateurs possess transmitters of extraordinary efficiency and these may be converted to the assigned police frequency with very little manipulation or adjustment. Remote-control lines may be very easily set up, and, without moving or seriously disturbing the amateur's equipment, police broadcast may be continued without interruption while necessary repairs are being made to the police transmitter. The amateur has always been coöperative, and communication officers will find him ready and willing to assist.

A police radio transmitter should be ruggedly constructed of the best materials known to be suitable for radio telephone practice. The complete equipment should be arranged to operate directly from electric power of a readily available type. Starting, stopping, tuning, and maintenance of the equipment should be simplified, and of such nature as to permit its use by persons not particularly skilled in the operation of radio telephone equipment. All units of the equipment should be completely enclosed, with the enclosing material perforated to permit ventilation. Safety appliances should be attached wherever practicable. All doors to the transmitter-housing proper may be provided with switches which automatically shut off all power when the doors are open, thus giving protection to operating personnel from contact with high voltages. Further, as a protection against unauthorized entry and forewarning of sabotage or other damage to transmitting equipment, suitable alarm contacts should be provided in the immediate vicinity of the transmitter. In St. Louis, for example, the room in which the transmitter is placed, is so wired that entry is impossible without automatically sending in an alarm to officers in the dispatching room.

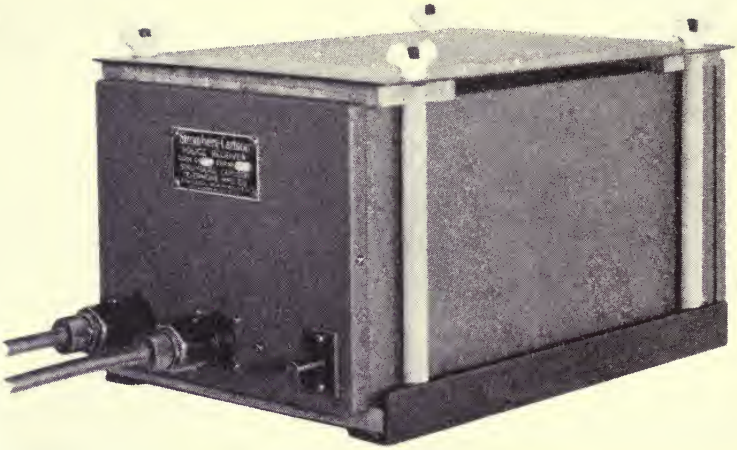
The antenna system, being unavoidably exposed to the elements, is subject to the ordinary processes of erosion as well as to other factors which may undermine if not cripple transmitter operation. The antenna is primarily an elevated wire,

well insulated from the ground, and should receive careful inspection at regular intervals, particularly with respect to insulation. If this equipment is carried away under storm conditions or in any other way seriously damaged, an emergency antenna should be erected at once, the following fundamental requirements of antenna installation being borne in mind: (1) erect as high as possible; (2) keep clear of buildings, commercial transmission lines, and other metal objects; (3) insulate carefully, particularly at the remote end; and (4) fasten securely. A supply of extra antenna wire, insulators, and other auxiliary equipment should be on hand at all times for making necessary repairs or substitutions. Antenna insulation may break down if the voltages or currents are excessively high, and, occasionally, as a result of the insulator's accumulating large quantities of dirt, soot, and moisture. Insulators should be cleaned whenever the operator notices a decrease in radiation resulting from this condition. The voltage in the antenna, when the transmitter is in operation, is greatest at the remote end, and the heaviest insulation must be provided at this point of high potential strain.

THE POLICE RECEIVER AND ITS REQUIREMENTS

The designer of police automobile receiving equipment must take into account inflexible requirements. Ruggedness of construction is essential in order that the instrument may be able to withstand hard everyday use in a moving automobile. It is desirable that the case or container be constructed of some indestructible material such as aluminum or steel. All parts should be so designed and constructed as to preclude the possibility of change in adjustment by severe road shock.

Ease of installation is important. In the early development of motor-car receivers, it was almost necessary to attach the car to the set. With the modern receiver, a mounting plate for the chassis and container is generally provided, which can be quickly installed on the bulkhead. The chassis and container hook into this plate quickly and securely. The magnamotor or other battery eliminator equipment and the loud-speaker unit



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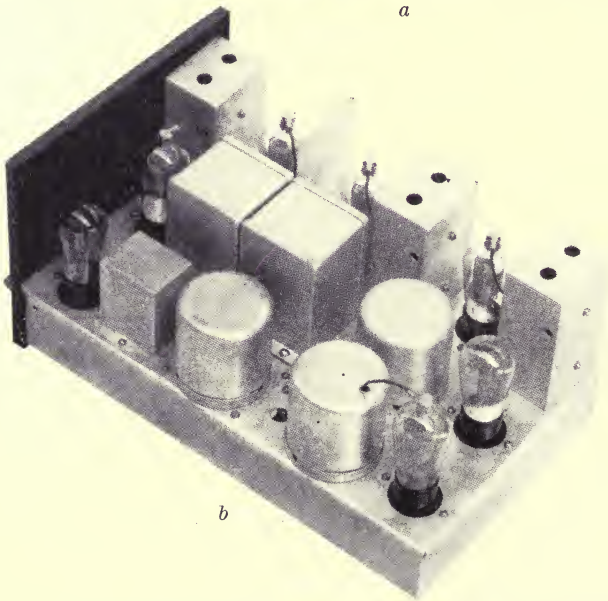

b

A radio receiver set for police patrol cars: *a*, the receiver, cased; *b*, the removable receiver chassis—which expedites servicing operations.

require but a few minutes to install, and three to five hours' work is now sufficient to make a complete autmobile receiver installation.

Compactness of units is recommended. The over-all dimensions of the receiver should be reduced as far as possible, since space is usually at a premium and the available locations for the receiver are few. The average dimensions of the modern police receiver are : chassis, height, 7½ inches, width 7 inches, length, 9 inches; container, height, 10½ inches, width, 9¾ inches, length, 12 inches. The receiver chassis and associated container should be arranged in such a way that removal of the chassis from the container does not involve the removal or disconnection of wires or tuning controls or of more than six retainer bolts or screws, including those used for holding the container cover in position. In some modern receivers, only one bolt has to be removed. The complete receiver unit should be such that without modification or alteration it may be rigidly mounted in an accessible position. The receiver chassis and its container should be so designed that all chassis are readily interchangeable without disconnecting any wires or controls. The working unit must be readily replaceable in tube failure or other trouble. A spare or emergency chassis can thus be inserted summarily and the police car remain in service. This is accomplished with the aid of aircraft-type connecting plugs and spring latches, which permit quick disconnection and reconnection. Other auxiliary equipment already supplied with modern receivers is available; this gives longer wear to the mounting and adds to the ease of servicing.

The electrical requirements of the police automobile receiver are severe indeed. This equipment must be many times more sensitive than any home receiver. Home receivers may operate with an antenna seventy-five feet or more in length; the motor-car receiver at best can have only a small antenna input. The sensitivity of the receiver should be such that, when used with an antenna having an effective height of 20 centimeters, a signal intensity of 10 microvolts per meter will produce an output of 150 or more milliwatts to the loud-

speaker, assuming that the input signal is to be modulated by 50 per cent. Selectivity should be such that, when a signal is given having a field intensity equal to the intensity of the signal to which the receiver is tuned but differing in frequency from the desired signal by plus 10 kilocycles per second, the given signal shall produce a signal input to the detector grid the level of which shall be 10 decibels or more down from the level of the signal to which the receiver is tuned.

It must also be possible to tune the receiver to the desired police frequency and to permit locking on that frequency in such manner that alteration of the adjustment by road shock will be impossible. Some departments make this locking feature so positive that the tuning adjustment cannot be changed by the operator of the car.

Wiring of the receiver installation should be so arranged that no connections or terminals are exposed. All connecting cables should be shielded with flexible copper braid shielding-material. The connections to be made in the installation of the receiver should be limited to one cable to the car storage battery, one cable to the battery eliminator, and one to the antenna.

In quality of reproduction, the receiver should possess audio-frequency characteristics such that the amplification is substantially constant from 70 to 5000 cycles per second. The audio system is designed in conjunction with the loud-speaker for clear speech articulation. Special emphasis has therefore been placed upon developing a receiver and speaker unit which will cover the voice frequencies efficiently. It is advantageous to eliminate from the design means for reproducing the very low or very high audio frequencies. The lows tend to overload the tubes, the highs only add noise.

The power output of the receiver should be such that the instructions coming from the transmitter can be heard through the loud-speaker when the car windows are open. The volume level required is higher than the volume level at which an ordinary conversation is carried on in a moving automobile.

Automatic volume control, already mentioned, should be incorporated in the police receiver. The mobile police set is subject to continual changes in the strength of the transmitted signal, occasioned by varying distances from the transmitter, the shielding effect of buildings, underpasses, and similar structures, as well as other phenomena connected with radio transmission. Without automatic volume control facilities, the officer would be under the handicap of almost continuously operating a manual volume control to compensate for the variations in signal strength.

The manual volume control, however, should be simple. Manual adjustment of volume by a potentiometer mounted on the steering column permits the car operator to adjust the volume of reproduction to suit his personal choice or to meet temporarily any special conditions. The control head generally includes the manual control knob, tuning dial, and on-and-off switch. Special jewel lights will indicate that the set is in operation and show when the sensitivity is at a maximum.

The cone type of speaker has taken first place in all modern radio installations, both stationary and mobile. For automobile use, particularly in police service, the magnetic cone speaker is used almost exclusively. In the electrodynamic speaker unit, a constant field-exciting current of six volts or more is necessary; this represents an additional drain upon the available current supply in the automobile; the use of the magnetic speaker does not involve this expense.

The position of the speaker unit is not extremely critical for good reproduction. Any service man, by testing the unit at different angles and locations in the car, can determine the place where reproduction is best. It is not always practicable to mount the receiver and speaker side by side in a location that is ideal for both. The bulkheads are usually crowded with automotive equipment, leaving often only the motor compartment for the installation of the receiver proper. The ideal position of the speaker is face out, with the unit flush with the instrument board; but this position is usually impracticable on account of the space factor. An alternative is to leave

it at the same approximate level but move it back to the bulkhead. In certain types of automobile receivers, where speaker and receiver are built together as one composite unit, the problem is somewhat simplified.

On the installation of the antenna, extraordinary limitations are imposed, chiefly because the effective height of a radio antenna from the electrical ground has a direct bearing upon its pick-up and the power of input to the receiver. In an automobile, the effective antenna height has to be extremely low because it is desirable that the antenna construction be concealed and inconspicuous, and a superstructure on top of the car is therefore impracticable. Almost all makes of automobiles are provided at the factory with a built-in roof antenna. The lead-in wire is usually brought down one of the front corner posts and coiled up behind one of the body lining sections, and it is only necessary to connect this lead-in to the shielded antenna cable of the receiver. The connection should be soldered and well taped. It is also important to make sure that the stranded metallic covering of the cable does not touch the wires at the joint when making the splice, as this will cause a grounding of the antenna.

RECEIVER CURRENT SUPPLY DEVICES

As the "A" or filament current is usually taken directly from the car battery, the amount of current used from this source is of vital importance. With the aid of recently designed tubes now available, the modern automobile radio receiver draws only 2.1 amperes, the amount of one headlight bulb. Ordinarily, the added drain on the car battery can be compensated for by advancing the charging rate. Radio-tube manufacturers have been giving this problem serious attention, and new tubes designed especially for low current consumption are constantly appearing on the market.

As a solution of the problem of plate current supply, the automobile radio battery eliminator has been designed as a substitute for the batteries formerly used in automobile receivers. The cost of the eliminator represents a much greater

investment than the initial cost of batteries, and the advantages of its use must be sufficient to warrant this larger outlay of money. Even the best available commercial B battery will not last more than three or four months on a basis of only four or five hours' service daily. Toward the end of this rather short life, the battery becomes erratic and unreliable in the discharge of its duties. The volume begins to fluctuate, and the reception becomes unbalanced and distorted, because the deterioration of the battery has progressed more rapidly in the heavier loaded units so that their voltage has dropped more rapidly than in the other units.

Service and replacement of batteries must be repeated frequently in the police patrol car, as the receiver is, as a rule, in continuous operation from eight to twenty-four hours a day. It is quite clear that, in the course of a year, the cost of battery replacements and service will more than equal the cost of an eliminator. This device has made possible a drastic reduction in the cost of receiver maintenance, since in police service the cost of battery replacements is the greater part of the cost of receiver operation.

The work of the B-battery eliminator is clearly defined. It must perform in continuous duty as well as the B battery at its best, maintaining at all times an output voltage sufficient to ensure good volume and to establish faithful reception. The voltage output must be reasonably free from impurities; that is, it must approximate as closely as possible the true direct current supplied by the B battery. The device must further have a fairly close voltage regulation; the high-voltage output should not vary much with changes in the low-voltage supply and with fluctuations in the milliampere load, represented by the receiver. It must be small, compact, light, and easily mounted.

It is of the greatest importance that the eliminator should make but a low current drain on the car battery. In every new automobile design additional devices are installed and additional duties imposed upon the car lighting system, the generator, and the six-volt car battery. An increase in the

capacity of the generator and battery might not seem very difficult at first; nevertheless it would necessitate changes in the design of the electrical wiring and equipment, and to these the automobile manufacturer is generally opposed. It is therefore essential that the drain from the car battery be held as low as possible, so as not to interfere with the starting of the engine and the operation of the ignition and lighting systems. A current drain of more than three amperes for such apparatus is definitely undesirable.

The eliminator must be noiseless in operation. An inherent characteristic of voltage-conversion devices is the presence of sparks or electrical contact disturbances, and this makes it necessary that the unit must contain sufficient and adequate filtering equipment. In the interrupter type of converter, the filtering is somewhat more difficult than in rotating conversion devices, but these have the disadvantage of generating a mechanical noise. The device must be durable, uncomplicated, and strongly constructed so that it will require a minimum of service and attention. The minimum adjustment period of such a unit should be well over two thousand hours of actual running.

It must be economical in cost; a list price of more than three times that of a battery replacement is expensive for this unit. The eliminator should earn its keep in one year. Such equipment should further be mechanically foolproof; all rotating, moving, or vibrating parts must be subjected to as little wear as possible. Vibration from moving parts should be kept at a minimum. Variations in temperature should have no influence on its operation. It should be as nearly dustproof and waterproof as possible. At the same time, all wearing parts should be easily accessible and their replacement quick and simple so that the service man may make necessary changes in a minimum of time. Finally, the life of the eliminator should be at least that of the average automobile—from three to four years.

INSTALLATION OF THE POLICE RECEIVER

Numerous automobile receivers fully capable of meeting all the requirements of police service are commercially available. The installation, as all who have had experience will testify, must be done within most exacting limitations. The person making such an installation should be something of an expert automobile mechanic, and in particular he should possess an engineering knowledge of radio circuits and design, if the work is to be satisfactorily done. The best receiving equipment is worthless unless the installation is made according to accepted standards and with due regard for the mechanical and electrical requirements of the receiving apparatus. All manufacturers send detailed installation instructions with their instruments, and so far as practicable these instructions should be followed. Before installing the receiver, the units and all associated equipment should be checked against the shipping list. The general order of installation is to mount the control unit, chassis plate, chassis, flexible drive shaft, speaker, battery eliminator, and antenna, and then to install the suppressors and condensers for the elimination of noise caused by the ignition system and the generator.

SELECTION AND PURCHASE OF POLICE RADIO EQUIPMENT

Actual purchase of transmission and receiving equipment should be preceded by competitive bidding on a rigid set of specifications. Bids should be asked only of concerns capable of engineering such an installation successfully. The specifications and bidding instructions employed by the city of Milwaukee, Wis., in the purchase of police radio equipment, have been suggested by the *American City Magazine* as a suitable standard. With minor changes and variations to meet certain local conditions, the Milwaukee form (see Appendix 1, p. 483) may be used to advantage in the intelligent selection and purchase of police radio system equipment in the open market.

CONSTRUCTION PERMIT AND STATION LICENSE

For the protection of radio communication in general, a code of government regulations has been set up covering the licensing and operation of radio transmitting equipment. No one can install a radio transmitter without first obtaining from the Federal government, after written application, the authority to do so, and no license will be granted for the operation of any station unless a permit for its construction has been granted by the licensing authority, upon written application therefor. Applications for construction permit or modification thereof, involving removal of transmitting apparatus and/or installation of new transmitting equipment, must be filed at least sixty days prior to the contemplated removal and/or construction.

Construction permits are usually required to specify a maximum of sixty days from the date of granting as the time within which construction of the station shall begin, and a maximum of six months thereafter as the time within which construction shall be completed and the station ready for operation. Any application for extension of time within which to complete construction of the station must be filed at least thirty days prior to the expiration date of the original permit. Application for the station license must be filed prior to any service tests made with the completed installation.

When construction of the station is completed and regular application for license is filed in exact accordance with the terms of the construction permit, the department is automatically authorized to begin service tests, using the equipment, power, frequency, and hours of operation specified in the construction permit. Such tests may continue for a period of not to exceed thirty days, provided the licensing authority is notified two days in advance of the beginning of such service tests. Authorization for service tests is not to be construed as constituting a license to operate. Under no circumstances may the station be operated under the construction permit except for testing purposes, until a regular station license has been

granted by the government. Application forms for construction permit and station license may be obtained from the Federal communications supervisor of the district in which the proposed station is to be located, or from the Federal Communications Commission at Washington, D. C.

It is further required that one or more licensed operators shall be on duty at the place where the transmitter is situated, and whenever it is in operation. Details concerning examinations conducted for licensing of operators may be obtained from the two sources mentioned above. Finally, communication officers should be thoroughly conversant with the provisions of the Radio Act of 1927, the rules and regulations of the Federal Communications Commission, and the general and special orders issued by that body from time to time. A law-enforcement organization should be the first to set the example in complying strictly with the laws and regulations governing radio communication.

SPECIAL ASPECTS OF POLICE RADIO COMMUNICATION

THE SERVICE ORGANIZATION

A radio receiving set is a comparatively delicate affair, and it is therefore subject to service failures if there is any serious disturbance of circuit adjustments or connections. This is particularly true of automobile receivers, which must constantly bear the brunt of road shock and other hard usage characteristic of service in a moving automobile. It is therefore very important that proper attention be given to the economical and speedy servicing of patrol-car radio equipment.

The radio patrol service unit should be so manned and equipped that thoroughly satisfactory repairs can be made both rapidly and economically. The men responsible for this type of work should be highly experienced transmitter and receiver operators with a thorough understanding of the radio circuits commonly employed in police equipment.

The number of men detailed to the radio service organization is chiefly determined by the number of radio patrol cars

in service. Properly equipped, one efficient service man should be able to take care of the service requirements of from thirty to forty patrol cars, provided his time is not encroached upon by other duties.

Most police radio-service organizations are housed in a centrally situated shop, with a complete assortment of the necessary tools and instruments, and a fast service car is provided to expedite servicing of cars in the field. Effective use of the service car has reduced markedly the average time out of service per receiver. In Chicago the city is divided into three equal sections, with a service car covering each section. These cars, which are in operation twenty-four hours a day, are directed by radio to the squad cars that develop any defect in their radio equipment. Each service car carries spare and replacement parts of all kinds, together with specialy designed test equipment for checking receiver operation. Similarly, in Los Angeles and other cities, a radio-equipped service car is immediately dispatched to the point from which a radio patrol car, over the beat telephone system, has reported a defective receiver to the complaint board. Major repairs are made in a well-equipped repair shop.

The introduction of the removable chassis was a great help to police-automobile receiver construction. Where minor adjustments will not suffice to place a receiver in operating condition, the defective chassis is immediately removed and another slipped in to take its place. This has done much to expedite the servicing of radio patrol car equipment. The defective chassis is taken to the shop for thorough inspection and repair.

The technique of radio servicing has called forth many conflicting opinions, and the subject is further complicated by the frequent introduction of improvements in radio equipment. There recently appeared on the market within a period of two weeks sixteen or more new types of receiver tubes. It is still possible, however, to make certain fundamental steps in the procedure of receiver testing and servicing, which are likely to hold good for some time to come. Probably the one or-

ganization that has done more than any other to stabilize this important field in the radio industry is the Institute of Radio Service Men, with headquarters in Chicago. In the journal published by this organization, professional service men will find the latest information obtainable about the equipment and technique of radio servicing.

With the development of present-day radio communication, there have appeared instruments specially designed to expedite the checking and measurement of electrical values within the suspected circuits of a defective receiver. Several reliable testing instruments or set analyzers are now available which make possible a speedier service. Manufacturers send with this type of equipment detailed instructions for making a rapid analysis of the condition of any radio receiver.

THE PROBLEM OF EXTERNAL INTERFERENCE

Since the operation of the radio-patrol receiver is directly affected by electrical interference from external sources, this subject should be given more than passing mention here. In many cities radio-patrol operations have been seriously crippled as a direct result of this sort of avoidable interference, which is entirely foreign to the electrical system of the car, and which tends to reduce the signal strength of police broadcast. External interference with the radio receiver installed in a moving automobile has to do with extraneous electrical noises which have their origin outside of the automobile and receiver electrical system. Two kinds of external interference are generally recognized: natural or meteorological, and "man-made." The former, which consists generally of a series of electrical discharges caused by disturbances in the atmosphere, such as thunderstorms, northern lights, and heat lightning, does not assume serious proportions in police broadcast operations. With respect to man-made static or interference, the situation is quite different. Some part of virtually every electrical device is potentially a radio transmitter, the radiations of which may be received in the police receiver with such intensity as to confound the desired reception entirely.

Consideration of some of the common sources of man-made static will indicate the scope of the problem and some of the methods of solution.

Electrical apparatus having a make-and-break contact contains the essentials of a spark transmitter, and thus a loose, dirty, or corroded connection may cause trouble. Some of the more common of the appliances liable to this fault are motor generator sets, electric elevators, dental laboratoy equipment, diathermy machines, violet-ray and X-ray machines, high-tension lines, defective power transformers, street-car electrical systems, flashing signs, traffic signals, arc lights, and motion-picture machines.

The interference created by a motor generator set is usually heard as a high-pitched crackling sound, varying slightly in intensity from time to time. This interference originates at the D. C. end of the machine when it is used for converting direct current to alternating current, and may originate at either the D. C. or the A. C. end when the machine is used in changing alternating current to direct current. Usually, however, A. C. to D. C. converters employ three-phase motors, which are not likely to create radio interference.

Interference from the motor generator set usually originates at the brushes and commutator of the motor. This interference, which is caused by the making and breaking of the electrical circuit, is impressed on the direct-current lines supplying the motor, is distributed along these lines, and, being radiated from them, may be picked up by the antenna system of the receiver. The procedure necessary for suppressing interference from this type of equipment will vary with the apparatus used, its location, and the manner in which it is installed. As a rule, it is necessary that a filter of the inductive-capacitive type be applied at both the D. C. and the A. C. end of the machine.

The first and most obvious source of street-railway interference is to be found in the driving motors of the cars. Since the motors are in operation almost all the time a car is moving, the interference which they create is a serious impedi-

ment to radio reception. Call buzzers, light switches, door switches, the controller mechanism, and intermittent contact between trolley wheel and trolley wire, or between car wheels and rails, may also be sources of troublesome interference.

The interference created by the various parts of the street-car is carried along the power, lighting, heating, and signal circuits of the car, many of which are cabled together or parallel each other, thus making for ease of inductive or capacitive transfer of interference from the circuit in which it originates to the other circuits of the car. From any of these circuits, interference may be conductively impressed upon the trolley wheel and trolley wire, or it may be radiated from the car wiring and picked up by the trolley wire. The interference which reaches the trolley wire, either by direct connection or by inductive coupling, may be distributed along the entire trolley-line system. Trolley-contact interference is caused by rapid changes in the resistance of contact between trolley wheel and trolley wire. These changes cause fluctuations in the flow of current to the car so that, even though there may be no measurable interruption of the flow of current, an electrical disturbance which will cause radio interference is likely to result. Further, the passage of a car under power over a section gap results in the creation of interference from the interruption of current flow. On a heavily traveled line, this interference may be decidedly objectionable. Expert use of filters in the electrical system of the car, and proper bonding of rails, are generally recommended for the elimination of street-railway interference.

Traffic-control apparatus is a frequent source of external interference. Both the flashing beacon used as a warning signal at dangerous crossings and the synchronized or progressive form of traffic-control equipment may cause radio interference when operated electrically. Interference from this source depends in large degree on the manner in which the flashing beacon is installed, and on the power and telephone wiring arrangement. If all wiring is exposed, and particularly if the leads between the flasher mechanism and the load

are long, the interference may be present at a distance as great as one mile from its origin. However, it is usually noticeable only within a few blocks of the beacon.

Synchronized traffic-control apparatus may produce interference consisting of a steady clicking, usually at such a frequency as to constitute an almost continuous roar, punctuated by clicks of greater intensity as the various indicating circuits are switched on and off. Since a synchronized traffic-control system may extend for several miles, the interference may be present in the entire area covered by the traffic-control system. Proper installation of filters or condensers offers a definite solution to this problem.

Although no attempt is here made to discuss all the possible sources of external interference, mention should be made of electromedical apparatus, since these devices are quite troublesome. Unlike most other electrical devices, which create interference in their immediate locality only, certain types of high-frequency apparatus set up interference which may destroy reception over a large area. In fact, in some places where the supply lines to the apparatus parallel the primary supply or telephone circuits, the disturbance may be spread over quite a distance, and may even be carried into cities several miles away.

A diathermy machine is a device for the production of high-frequency currents to be used in the treatment of certain diseases. The circuit used for obtaining these frequencies is essentially the same as that employed in early spark transmitters, the operation of which is now forbidden by Federal law. In the diathermy machine a transformer, a condenser, and adjustable spark gaps are used to produce high-frequency currents. These currents are carried along flexible leads to metal electrodes which are applied to the body of the patient. The maximum high-frequency current used in diathermy treatments is usually 4000 milliamperes, or 4 amperes. When it is understood that a radio transmitter with an antenna current of 4 amperes may have a working range of several thousand miles, it is obvious that a diathermy machine

can do a good deal of damage to radio reception. Fortunately, the apparatus is not designed for maximum radiation at the frequencies used, and consequently the area affected by the direct radiation from the electrode leads is relatively small. This directly radiated interference seldom affects receivers that are more than 200 feet from the machine. The greater part of the destructive interference is carried along wiring circuits in a manner similar to the transmission of "wired wireless," or, more correctly speaking, carrier telephony. The high-frequency currents flowing in the electrode circuit of the diathermy machine cause voltages of the same frequency to be induced in the primary circuit of the transformer used and thus to be superimposed on the power supply line. The high-frequency currents flowing as a result of this induced voltage may travel back along the secondary distribution network for many miles unless a suitable filter is installed in the power supply line to the diathermy machine. Occasionally it is necessary to enclose the apparatus proper within a copper screen or shield. Ultraviolet and X-ray machines present similar problems. Once the source of interference is found, an expert electrician can recommend the procedure necessary for its elimination.

About power-line interference much is yet to be learned, since its amount and extent is in large part dependent upon local conditions. In surveys conducted by field engineers, interference actually arising on power lines has been found in many instances to represent less than 7 per cent of the interference complaints reported. The reports of radio-coördination departments of public utilities show that power-line interference is the cause of between 5 per cent and 30 per cent of all interference complaints received. A "leaky" transformer is a myth repeated so often that it is generally believed to be true. Such a condition could not be a continuing source of radio interference, since any leak in a transformer of sufficient magnitude to cause radio interference would bring about an early breakdown of the transformer and its prompt removal from service.

Almost all of the interference apparently attributable to distribution transformers has been the result of arcing at the contacts of the plug-type primary cutouts. After primary cutouts have been in service for some time, the contact springs tend to lose their tension, with the result that arcing takes place, causing radio interference which is likely to be distributed along both the primary and the secondary distribution networks. The effective remedy is simply the installation of a new cutout.

Improper spacing of strain insulator bolts and metal crossarm braces may occasion radio interference. In one instance a transformer installation was found in which the metal crossarm braces were so close to primary insulator pins that infinitesimal discharges of high-frequency voltage produced much interference.

A study will show the similarity of a power line, a strain insulator, and an insulator bolt, to a condenser. The two plates of the condenser are the power line and the insulator bolt, and the dielectric of the condenser is the insulator. As the power line bears a continually varying charge, it is obvious that the insulator bolt, which is the opposite plate of the condenser, will also bear a continually varying charge. Although the quantity of this charge may be extremely small, the radio-frequency energy developed when the charge leads off to ground or to a metal object having a different charge (such as another insulator bolt, a metal crossarm brace, or a crossarm bolt) is impressed on the high-tension line and also on the low-tension line by this same condenser action, and is thus distributed along the wiring system.

Some of the most common sources of power-line interference are: loose line connections; tree grounds, slight or otherwise (voltage about 1000); arcing fuse contacts; arcing contacts in cutouts; loose fuse or cutout contacts; defective lighting arrestor; defective insulators; loose street lamps; poor or loose grounds on neutrals; defective or broken transformer bushings; loose transformer cores (not always); and guy wires across lines (not necessarily grounded).

An interesting example of transmission-line interference was reported some time ago. An 11,000-volt line which passed within a short distance of a cement mill seemed to be extremely noisy. Investigation disclosed that the noise was caused by leakage across insulators, the leakage being the result of a deposit of cement dust on the insulators. In order to keep this line free from noise, the insulators are now washed periodically to remove the coating of cement which caused the leakage and consequent interference.

One further source of interference found on transmission lines is the corona discharge which takes place when long ends are left on insulator tie wires. This interference may travel for some distance along the transmission line. The remedy is to cut short any loose ends of tie wires in order to eliminate the discharge.

Extensive research on the problem of transmission-line interference is being carried on by power companies, universities, the National Electric Light Association, and many independent engineers. At present a complete outline is not available, but the attention that is now focused on the problem seems to promise a satisfactory solution at an early date.

The few illustrations just given afford some idea of the way in which external interference originates and travels. It may assume such proportions as to warrant the adoption of special means for its elimination. Although the field-intensity survey previously outlined as a prerequisite to the proper location of the transmitter may reveal many sources of external interference, it may also be advisable to make an interference survey of the area served. The significance and value of such a project is amply illustrated by the fact that, in a number of cities, civic organizations have instituted these surveys because of the destructive effect of external interference upon broadcast reception. At this writing, no such survey looking toward the improvement of patrol-car reception has been made by a police department, but with an inevitable refinement in police radio technique and operation, this may be a logical future step.

The interference survey, so far as the technique is concerned, resembles in many respects the field-intensity survey. An interference locator is employed, which is, in reality, a very sensitive portable radio receiver, light enough to be carried easily by one man. One such instrument, now available on the market, employs a four-stage tuned radio-frequency amplifier to obtain the extreme sensitivity necessary. The input circuit is so designed that it may be tuned to various types of antenna, thus providing a maximum of sensitivity under all conditions. A filament control knob operates a rheostat governing the voltage applied to tube filaments, and a meter connected in the filament circuit indicates the applied voltage. By depressing a button at the top of this meter, the plate voltage may be read.

The human ear unaided is a poor indicator of noise intensity, being rather easily overloaded so that, after a certain noise level has been reached, it does not respond to further increases in noise. The intensity meter is not subject to these limitations, and will continue to record increases of interference intensity after the ear has become overloaded. The intensity meter also makes possible a comparison of interference intensities. The sensitivity control of the instrument is set at a predetermined position and the meter deflections under varying interference conditions may then be noted. A frequency selector, or tuning dial, is provided at one side of the control panel.

In order to permit the detection of electrical disturbances in the audio frequency range, a jack, marked "audio," is provided on the top panel. When the plug of the audio coupling unit is inserted in this jack, the signal is impressed on the primary of the first audio-frequency transformer; consequently, there is no possibility that a radio frequency impulse will be indicated by the output meter when this jack is being used. This instrument is powered by self-contained batteries, and is also equipped with jacks for the use of external battery equipment. When fully equipped with tubes and batteries, the instrument weighs approximately thirty-five pounds.

The purpose of the survey is to discover and identify the sources of interference in order that recommendations may be made for their elimination. Although the services of an interference expert are to be preferred, the radio technicians connected with most police departments are fully competent to make such a survey with the aid of equipment similar to that described above. Local radio dealers, amateurs, and citizens whose interests are directly affected may be encouraged through suitable publicity channels to report sources of interference that come to their attention. Most broadcasting stations will coöperate in any movement that will help their own listeners to obtain better reception. The following partial report of an interference survey recently made by interference engineers, indicates the scope of such a project.

ENGINEERING REPORT OF AN INTERFERENCE SURVEY

Heavy general interference.—Area: section bounded by River, North Main, Center and Niagara streets. Source: Corona discharge on high-tension line coming in on Washington Avenue and Bridge Street. Various electric motors and sign flashers.

Heavy individual interference.—Area: North Main and East Center streets, with center of disturbance on Third and Newport avenues. Source: large diathermy machine in Dr. Briggs's office. This interference blankets the entire area, preventing the reception of even local stations. Dr. Briggs also operates an X-ray machine.

Other individual interference.—Area: all sections. Source: oil burners, sewing machines, commercial motors and sign flashers (business blocks), fire-alarm generator, Western Union Telegraph Office, and automatic dial telephones.

Interference cleared.—Power lines: with the aid of Power Company line crew, all sources of line trouble, such as tree grounds, broken insulators, loose cutouts, ground leaks (defective insulation underground), and other small defects found were cleared up. Interference carried on power lines from other sources cannot be immediately remedied. All interfering appliances will require the application of proper filter to silence the interference caused by their operation.

High-tension line, 33,000 volts.—Relief from this source of trouble may be secured by either moving the line away from other parallel 2300-volt feeders, or by the use of "no-static" insulators and wooden crossarms. Present construction is wooden poles, steel "wishbone" crossarms,

and porcelain pin type insulators. A 2300-volt feeder is carried on the same poles and picks up interference of the 33,000-volt line.

Recommended installations.—Factory, 326 River Street: filter on battery charger generator; bad interferences.

General recommendations.—(1) Application of proper filters to all new installations of interfering appliances. (2) Use, by Power Company, of interference locator, to check its line and other interference. (3) Periodic trimming out of tree branches to prevent tree grounds. (4) Use of latest type porcelain cutout boxes. (5) Bringing in of high-tension lines down upper Belmont Avenue, instead of through Washington Avenue. This would require the changing of about six miles of line.

In many places, local ordinances have been drawn to compel owners of disturbing machinery to suspend its operation, or to adjust it so that no interference will be created.[4] Such ordinances must be so drawn that they will not conflict with Federal laws and should be so phrased as to be inapplicable to persons who are not guilty of willful or negligent disregard of the radio-reception rights of the community.

In a *Bulletin* of the Federal Communications Commission issued in 1935, the following remarks are made.

The spark and the arc, together with their accompanying radio interference, are found in hundreds of appliances in common use. In some such appliances the disturbance is a necessary part of the apparatus. Examples of this are the X-ray, violet ray, and diathermic machines.

In these, radio interference is cured or prevented by the insertion of attachments which prevent the flow of the radio frequency impulses back into the power lines for general dissemination. In other devices, the interference is not necessarily produced by the operation of the device, and is due only to improper design, or to a defect which has developed. Devices of this character are heating pads, vibratory battery charges, electric sign flashers, motors and controls such as those used in vacuum cleaners, electric refrigerators, washing machines, elevators, and innumerable other devices.

The holding of the householder to a criminal or penal responsibility because of the mere ownership or operation of a device within this classification, is certainly unjust. In many cities, however, ordinances of general application have been enacted where the real purpose has been to reach individual offenders who knowingly and persistently operate interference-producing devices of wide effect, refusing to attach corrective apparatus or to make repairs. As to such persons, ordinances are valid,

[4] See Appendix 3, p. 494, for examples of municipal legislation on this subject.

if reasonable. In such applications, the ordinances are in no wise burdens on interstate commerce, but are rather in aid thereof. They come within the power of the State to prevent and abate nuisances.

Whether the device causes interference through lack of choke or filter attachments, or through improper design, the cure for the interference lies in the education of the manufacturer. Many brands of devices have become specifically known as interference producers, and this reputation is compelling manufacturers to improve their construction. Already a large number of such appliances carry the guarantee of the maker that they will not produce interference with radio reception. The importance of the work along this line of trades associations has been tremendous, and the time will arrive soon when this type of interference will no longer exist.

Regulations such as those just described are designed particularly to remove conditions which interfere with broadcast reception. Their enactment of course automatically improves the situation in respect to radio patrol-car operation. Generally speaking, the broadcast frequency channels are more subject to the vagaries of external interference than are the police frequency bands. Occasions frequently arise, however, in which patrol-car reception over a comparatively wide area is difficult because of high-frequency radiation from some piece of electrical equipment. Once found, the source of the interference may usually be corrected without resort to legal means, by approaching the owner of the suspected apparatus and suggesting the necessary changes. The police will, as a rule, be given the best of coöperation in such matters. If the owner is obstinate, the city attorney should be consulted.

RADIO LEGISLATION

Radio legislation, so far as the police department is concerned, is not limited to city ordinances providing for the reduction and elimination of external interference. In national, state, and municipal jurisdictions, rigid laws have been enacted and are now in force, which have a direct bearing upon the installation and operation of police radio communication systems.

In the regulation of radio communication, legislators are under the necessity of making their enactments conform to

the invisible laws of nature. All that can be intelligently discussed or made the subject of treaties, laws, and regulations, is fundamentally the question of the use of the ether for the operation of transmitting stations and receiving sets.[5] If excessive numbers of radio stations are permitted to propel waves into the ether, the resulting interference will decrease the usefulness of this new medium of communication and, if great enough, would make it useless to everyone. No other kind of business presents this peculiar dilemma. The fact that there are such obstacles in the business of radio communication means that, instead of the comparatively slight amount of regulation that would otherwise be necessary, nations must bind themselves by treaty to obligations which they would not accept with reference to any other activity. Furthermore, the radio administration within a nation must have a decisive power over the radio operations of its nationals, such as it neither has nor desires over their other activities.

If the ordinary receiving set used for the reception of broadcast programs could cover the entire span of the radio spectrum, including both the low- and the high-frequency bands, the listener, by turning the dial above or below the present popular broadcast limits, would encounter a world of activities in radio communication the existence of which he hardly suspects. By turning the dial into the low-frequency band, he would hear the familiar dots and dashes of the telegraphic code used by ships in communication with each other and with the shore, by aircraft, by government stations, and by stations engaged in transoceanic communication. He might also hear the wireless telephone service which spans the Atlantic and the Pacific. By turning the dial toward the high-frequency band, he would again hear ship, aircraft, government, and other stations engaged in telegraphic communication with foreign countries, and also within the United States. He would also intercept the messages of any one of a hundred or more police transmitters directing radio-equipped patrol cars to scenes of crime or of various emergencies. In

[5] Stephen Davis, *Law of Radio Communication.*

this section of the frequency spectrum he would be able to listen in on amateurs and experimenters, and even to hear broadcast programs being transmitted on the high frequencies from stations in the United States to remote foreign points. If he had the proper equipment, he would receive still and motion pictures transmitted by stations experimenting with television; he would hear stations used by oil companies prospecting for oil in the Southwest, by power companies, by state departments of agriculture, and by railroad freight and passenger trains.

The orderly regulation of the extremely limited channel of communication which must be made to accommodate the requirements of these various services is a problem of the first magnitude, and requires judicial and engineering skill of a new order for its intelligent solution. This regulation is effected in large measure through a definite allocation of parts of the radio frequency spectrum to the various services which make use of this form of communication.

Federal regulation.—The first recognition of wireless telegraphy in the laws of the United States was the passage of the Ship Act of June 24, 1910 (36 Stat. L., 629), effective July 1, 1911. This regulation was directed solely toward better protection of life at sea; it required the installation of wireless equipment on every passenger vessel carrying fifty or more persons, including passengers and crew. Limitations of wireless transmission at that time are reflected in the provisions of the act, which required that the apparatus used should be capable of transmitting or receiving intelligence over a distance of at least one hundred miles.

Power to make regulations for the execution of the Act was conferred on the Secretary of Commerce, and enforcement duties were made a responsibility of the Bureau of Navigation, which had charge of the enrollment and licensing of vessels. Through this Bureau, the Secretary of Commerce exercised all regulatory powers concerning radio communication. Aside from an additional act passed on August 13, 1912 (37 Stat. L., 302), dealing with radio apparatus on merchant

ships, no further legislative action of importance was taken until the passage of a bill, which was approved by the President on February 23, 1927 (44 Stat. L., 1162), creating the Federal Radio Commission.[6] Prior to 1927, Congress had given some attention to the problem of radio control, but action had been delayed[7] because of the coupling of regulation of transmission with the suppression of alleged monopoly in apparatus resulting from the pooling of patents.

As created under this Act, the Commission was to possess Federal credentials as the original licensing authority for a period of one year, at the expiration of which time the Secretary of Commerce was to succeed to the licensing authority, and the Commission to become an appellate body. The Commission was to consist of five members, to be appointed by the President, with the advice and consent of the Senate. The powers specifically conferred on the Commission were as follows: (1) to classify stations; (2) prescribe the nature of service to be performed; (3) assign frequencies or wave lengths to stations or classes of stations, determine the power to be used, and allocate the time of operation; (4) determine the location of classes of stations or individual stations; (5) regulate the apparatus to be used with reference to its external effects and the purity and sharpness of emissions; (6) make regulations to prevent interference; (7) establish zones to be served by any station; and (8) make special regulations applicable to chain broadcasting.

As the end of the statutory period approached, it became evident that the licensing authority would have to be continued in the Commission, or that the Secretary of Commerce would be compelled to assume this great burden. An act extending the licensing power of the Commission was approved on March 28, 1928 (45 Stat. L., 373), and once again the Commission's power in the field of radio regulation was continued for one year, that is, until March 16, 1929.

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[6] The name was changed in June, 1934, to Federal Communications Commission. See below.

[7] Laurence F. Schmeckebier, *Federal Radio Commission.*

When the first regular session of the Seventy-first Congress convened on December 2, 1929, the President, in his annual message, recommended that the licensing power of the Commission be made indefinite, saying:

> I recommend the reorganization of the Radio Commission into a permanent body from its present temporary status. The requirement of the present law that the commissioners shall be appointed from specified zones should be abolished and a general provision made for their equitable selection from different parts of the country. Despite the efforts of the commissioners, the present method develops a public insistence that they are specially charged with supervision of radio affairs in the zone from which each is appointed. As a result there is danger that the system will degenerate from a national system into five regional agencies with varying practices, varying policies, competitive tendencies, and consequent failure to attain its utmost capacity for service to the people as a whole.

The work that had been accomplished in establishing some semblance of order in a field characterized by much confusion and chaos reduced Congressional opposition to the proposal that the Commission be vested with continued authority to function. Accordingly, there was passed without debate the Act of December 18, 1929 (46 Stat. L., 50), placing the licensing authority in the Commission "until such time as is otherwise provided by law."

In June, 1934, a Communications Act was passed abolishing the Federal Radio Commission and transferring its records and functions to the Federal Communications Commission, together with all duties, powers, and functions of the Interstate Commerce Commission relating to the operation of telegraph lines. This new commission is composed of seven members appointed by the President by and with the consent of the Senate, and is divided into three sections, namely, broadcast, telegraph, and telephone.[8] So far as regulation of radio and police communication is concerned, this agency succeeded to the responsibilities, and now performs the functions of its predecessor, the Federal Radio Commission.

[8] *Congressional Directory,* 74 Congress, 1 Session, ed. 1, corrected to December 20, 1934, p. 516.

The Radio Act of 1927, in addition to creating the Federal Radio Commission, codified into an established body of law certain measures for the regulation of radio communication. This Act, together with subsequent additions and General Orders issued by both commissions, provides the sole regulation of a new industry, which for a period of years presented—and still presents—a problem of major proportions. It is to the Commission, and under these regulations, that police departments must apply for the license and authority to operate a police radio communication system. The regulations should therefore be carefully studied, not only that they may be obeyed to the letter, but also that changes necessary to the future welfare of police communication may be recommended.

State regulation.—Several states have attempted to enact legislation concerning certain conditions that directly affect the police communication system. The questions of legal theory and states' rights said to be heavily involved in such legislation, we shall leave for the jurists to settle, and consider now a few of the statutes that the states have enacted on this subject.

State radio legislation is almost invariably limited to matters which concern the police power. Almost all the state statutes deal with the prohibition of short-wave receiving equipment in other than police cars, an attempt, however ineffective, to prevent the criminal use of police information. It is clear, however, and it is the growing consensus among police officials, that secrecy is impossible of attainment through legislative channels. Nevertheless, inherent in this type of law there are certain advantages to the police which are not to be overlooked.[9]

Municipal regulation.—In addition to regulatory ordinances covering the reduction and elimination of external interference, cities have enacted legislation designed to improve the police radio communication system. This legislation deals in large part with the so-called "ambulance chaser" and others who seek to exploit police broadcasts for personal ends, and

[9] See Appendix 5, p. 502, for state laws on this subject.

with the regulation of short-wave receiving sets in automobiles not intended for use by the police.[10]

THE POLICE USE OF COMMERCIAL BROADCASTING STATIONS

In the beginning of police radio communication an attempt was made to use commercial broadcasting stations, since they were already established and in operation. Many of the original experiments with radio receiving equipment installed in an automobile were made possible through the coöperation of commercial stations, and, as we have seen, broadcasting facilities were subsequently employed to a limited extent in actual police operations, both in this country and abroad. Although this temporary arrangement was superseded by radio installations exclusively owned and operated by the police, the possibilities of the gigantic chain of communication represented by modern broadcasting stations should not be overlooked in contemplating the maximum use of radio facilities in police service.

The incredible coverage of these commercial stations, because of their power and the enormous distribution of household receivers, places them in the front rank as a communication agency in exceptional instances where it is desired to give information to the general public in a wide area. The Federal government, fully aware of the services that can be given by these stations in a national emergency, included in the Radio Act of 1927 the following regulation:

> Upon proclamation by the President that there exists war or a state of public peril or disaster or national emergency, or in order to preserve the neutrality of the United States, the President may suspend or amend, for such time as he may see fit, the rules and regulations applicable to any or all stations within the jurisdiction of the United States as prescribed by the licensing authority, and may cause the closing of any station for radio communication and the removal therefrom of its apparatus and equipment, or he may authorize the use or control of any such station and/or its apparatus and equipment by any department of the government under such regulations as he may prescribe, upon just compensation to the owners.

[10] See Appendix 4, p. 497, for municipal legislation on this subject.

The President shall ascertain the just compensation for such use or control and certify the amount ascertained to Congress for appropriation and payment to the person entitled thereto. If the amount so certified is unsatisfactory to the person entitled thereto, such person shall be paid only 75 per cent of the amount and shall be entitled to sue the United States to recover such further sum as added to such payment of 75 per cent will make such amount as will be just compensation for the use and control.

Up to the present time, the use of commercial stations by the police has been for the most part limited to the broadcast of descriptions and information connected with missing-person reports. Police departments have been able to cancel many such reports promptly through immediate coverage of the surrounding area over broadcast facilities.

In a recent situation involving the disappearance from Berkeley, Calif., of a sixteen-year-old boy, through the cooperation of commercial stations the author was able to throw out within a short time a radio net covering the entire Pacific Coast and Rocky Mountain area. Broadcasting stations in San Francisco, Oakland, Berkeley, Los Angeles, Portland, Seattle, Denver, and Salt Lake City gave out the particulars of his disappearance, together with a personal description, and he was found the following day in Vancouver, B. C.

It would be difficult to indicate the full implications to police radio communication of the tremendous area that, at every hour of the day and night, is being covered by commercial stations in the broadcast band. When broad dissemination of information is essential, these stations can be of almost immeasurable usefulness. Moreover, in respect to public relations, the wide contact made possible through police addresses, monologues, plays, and other similar radio programs, when properly presented, is hardly to be estimated.

Should there develop a more extended police use of commercial broadcast facilities, it is likely that some arrangement will be made whereby the management of such stations may be reimbursed for the use of their equipment, particularly in emergencies, when their services can be of such great material assistance.

Chapter V

RADIO PATROL OPERATION

Given a police radio installation in which the transmitting and receiving equipment meets all requirements, how shall the radio patrol be organized so as to take every advantage of the new communication system? All the technique of modern police radio communication is directed toward a reduction of the operating-time interval, that is, the interval between the commission of a crime and the appearance of officers at the scene. This critical period falls quite clearly into four well-defined divisions, each characterized by a specific function; namely: (1) the time between the commission of the crime and the moment when some person lifts a telephone receiver to call the police; (2) the time between the lifting of the receiver and the beginning of actual conversation between the person calling and the police department; (3) the time between this conversation and a broadcast of the report to police radio patrol cars; and (4) the running time of the patrol cars from the point at which they receive the broadcast to the scene of the crime. All four of these time divisions are extremely flexible and amenable to time-reducing methods of operation.

(1) *Time interval between commission of crime and telephone call to police.*—Because of the wide distribution of telephones in all communities, the telephone is the most convenient and most direct means of contact with the police department. The time interval between the commission of a crime and the moment at which a telephone receiver is lifted from the hook is an extremely significant one. It may vary from a few minutes to days or months. Some crimes are never reported to the police. Occasionally, they receive almost instant notification, and in that event the law-enforcement organization has a reasonable opportunity to function effectively. Chief Quinn, of the San Francisco Police Department, commenting on this subject recently, said: "The main diffi-

culty is the human equation represented by the reluctance of the average citizen to communicate with police headquarters after being attacked. . . . If the public can be aroused to the degree that they will immediately, or as soon as possible after the attack, communicate with their police departments, giving full particulars, the results will show great increases in arrests with consequent deterring of those who attempt to commit crime."

A reduction in this time interval may be made to a marked degree through well-directed educational work. The New York Police Department recently issued a pamphlet for distribution in that city, with this purpose in mind. Further, it placed at conspicuous points throughout the city large illustrated posters and placards emphasizing the necessity of telephoning the police without delay. Obviously, the elimination of delay in making the telephone contact is more than equivalent to a reduction in running time of patrol cars, to which the police have given considerable attention.

Commissioner Rutledge, of Detroit, in an address before the 1930 convention of the International Association of Chiefs of Police, emphasized the importance of speedy communication in police operating technique. "In the early days of police radio," he said, "my prediction that it would prove a valuable ally and police weapon, was regarded by many as 'visionary' and impractical. Now I suggest and predict the use in stores, and eventually in private homes, of automatic call systems, such as are now used in the banks to summon the police. I feel that this is one of the important developments to come in the future. Usually the victim of a burglary or a robbery is unable to call the police until after the thug has fled. Then he is so nervous or excited that he cannot give the police operators at headquarters his address or location, with the result that valuable time is lost. How much simpler and more efficient it would be if the business man could merely touch a button—even while the thug was still in his store, sending the police speeding to the scene. I believe this entirely practical."

In some foreign countries, particularly Germany, the tech-

nique and methods suggested by Commissioner Rutledge are widely employed.[1] At present, however, this method has the serious disadvantage of "blind" dispatching; only one element of the crime report is known—location. Officers dispatched to the scene in response to such a summons must perforce close in on the location in complete ignorance of the nature of the disturbance, whether a robbery, street fight, or an accident. The great hazard here is not the personal danger to police officers, since presumably they are out on duty, prepared and trained for any contingency; the hazard lies rather in the reduced efficiency of patrol operation. Owing to the absence of descriptions and other information, officers en route to the scene may actually pass by the car or individual wanted. Many other related disadvantages inherent in this particular system of notification now classify it as a secondary solution of the problem; but future developments in communication equipment and technique may eliminate all present objections.

Some signal boxes are so designed that a variety of code signals may be sent in to the police station, each representing a particular type of disturbance or of service required. This equipment is similar in many respects to the first automatic telegraph police boxes which were early employed on beats. As a means of present-day police communication, it must be eliminated at the outset on account of its complicated mechanism and operation. The first requirement of any communication device for reporting to the police is simplicity of operation, and in this respect the conventional telephone still holds first place.

2. *Time interval between lifting of the receiver and actual conversational contact with the police department.*—Generally speaking, it may be said that the second interval of delay is a responsibility of the telephone engineer; it represents the only one of time divisions 2, 3, and 4 over which the police have no direct control.

3. *Time interval between contact with police and broadcast*

[1] See "Police Communication in Germany," pp. 446 ff.

to patrol cars.—Delay at this point seriously cripples the efficiency of the entire communication system as well as of the department. The cause lies usually either in a traffic overload or a lack of organized operating procedure.

It is fundamental in police work that a signal on the exchange board indicative of an incoming call must be answered *without delay.* At the moment this signal appears, the responsibility of telephone traffic engineers ends; their work is accomplished. At that same moment the police organization should begin to function, but in far too many departments unnecessary delay is allowed to creep in. Frequently, tardiness in responding to incoming calls is traceable to the physical inability of any one individual to handle properly the volume of incoming traffic. The remedy here is obvious. All functions of the communications bureau should be coördinated and directed toward the elimination of delay and lost motion.

In this third time interval, we are concerned with the radio-dispatching unit of the police organization, upon which alone rests the responsibility for rapid technique in the delivery of orders and information to cruising radio patrol cars. Between the complainant or person reporting a crime, and the operating patrol cars of the department, there must be an intermediate agency for receiving reports and information and for directing the movements of the force to meet the emergency. It would be ideal if the complainant might get into direct contact with the patrol cars in his immediate vicinity. It would be a simple engineering matter to provide apparatus for automatically routing the voice of the complainant through the speech-input system of the police transmitter. This is already done in the advanced types of automatic holdup- and burglar-alarm systems, and the principle employed may make possible sometime the fulfillment of Commissioner Rutledge's prophecy.

Even so, however, the complainant is still untrained in police technique and at the moment of reporting a crime, particularly a serious one, he is an emotionally unstable person

who requires skillful and expert coaching in order to get from him without delay the facts of a crime report that are essential for fast and intelligent police action. It is the primary function of the dispatching organization to act as an intermediate or connecting agent between the person or persons attacked and the police field strength which may be dispatched to handle the situation.

The qualifications of the police radio dispatcher are similar to those of the police telephone operator. (See Chap. II.) He should be capable of working at traffic peaks with a cool mind and should possess the ability to make decisive judgments that are correct. The entire dispatching unit should be so organized as to eliminate all lost motion and delay in moving the information from the complainant to the patrol force. Direct contact between the victim and the patrol car nearest him is the goal of police communication, and the necessary intervening agencies must therefore be reduced to the lowest possible minimum. In some departments this fundamental fact is appreciated, but in others the information may be relayed from two to four times before it finally reaches the input system of the transmitter.

There are three general methods of dispatching in general use. In the first, the functions of operation at the exchange switchboard and of dispatching are performed by the same person; in the second and third, these functions are separated and assigned to different persons, but there is a definite difference between the two in the manner of transferring the information from operator to dispatcher: in the second, a complaint record form is used; in the third, the dispatcher is put into direct contact with the person calling.

In the smaller communities, as in Kokomo, Ind., Tulare, Calif., and others, all incoming calls are received at the police exchange board by the desk sergeant, who also functions as the radio dispatcher. With the microphone and remote-control equipment mounted directly in front of him, he is able to broadcast alarms almost simultaneously with their receipt.[2]

[2] See description of the Berkeley police radio system, pp. 386 ff.

The number of intervening and time-consuming agencies between the victim and the patrol car is here reduced to the lowest possible minimum, and, in this particular, the combination police telephone operator and dispatcher gives a service somewhat superior to that afforded by the more complicated dispatching systems in the larger cities.

In the metropolitan area, the volume of emergency traffic requires special arrangements to accommodate the great flow of incoming calls as rapidly as possible. Dispatching procedure is more involved on account of the necessary decentralization of activities in the communication bureau. Here, the combination police operator and dispatcher gives way to specialization; functions and duties are divided in order to relieve congestion and provide maximum speed in handling the individual call for police assistance. Operating and dispatching become separate activities, and each is assigned to a single person. The second and third methods of dispatching, which are characteristic of the metropolitan system, therefore involve the receipt of the complaint information by the police operator and its transfer to the radio dispatcher for broadcast.

In the second method, this transfer is accomplished by means of a complaint record form, on which are written the essential details of the complaint or report as these are received by the operator. In Chicago, for example, all incoming calls for the police arrive at a central turret in the communication bureau on the eleventh floor of Police Headquarters building. Seated at the operating position in this turret is a woman operator who answers no calls, but transfers them immediately to that one of twelve or more independent operating positions in the same room which may be idle at the moment. Her function is that of a telephone dispatcher. Each of these operating positions consists of a small booth equipped with a standard telephone instrument and provided with a direct wire to either of two radio dispatchers, who are always on duty in the communication bureau.

Emergency calls, and all others requiring police assistance, are recorded on a specific record form by the operator receiv-

ing the call. Emergency reports are immediately transferred to the radio dispatchers for broadcast. Those calls not classified as emergencies are transmitted to precinct stations over telephone lines by operators who do nothing else but handle such precinct traffic. The significant characteristic of this method of dispatching is the preparation of an embryo complaint form by the receiving operator prior to actual broadcast of the report, as indicated below (p. 164).

Upon receiving an emergency report filled in on this form by the receiving operator, the dispatcher broadcasts the call and then passes the report form to the squad operator. Upon completion of a call, each patrol car is required to report back to the squad operator by telephone, giving the following information: location of car when call was received; time required to reach the scene of the call; nature of trouble and action taken, together with number of arrests made. This information is recorded on the original complaint form by the squad operator.

In Los Angeles,[3] a record form similar to the Chicago report is filled out at the police complaint board by the receiving operator, and is passed to the index operator, who ascertains the car making the particular call. He notes the number of the district or car and transfers the report form to the dispatcher for broadcast, after which it is passed to the disposition clerk. Officers make all reports relative to their action at the scene of the calls at their respective divisional headquarters. Dispositions are not transmitted direct to the disposition clerk, but through the divisional desk sergeant, in order to save the expense of using pay stations, as the officers may employ the Gamewell system for communication with the divisional office.

In the third method, the emergency call is transferred to the dispatcher, and he obtains directly from the victim or complainant the information necessary for broadcast. The volume of police broadcast, especially in the larger cities, precludes any extensive adoption of this method. However,

[3] See "The Police Communication System: Los Angeles," pp. 362 ff.

CENTRAL COMPLAINT ROOM REPORT

OPERATOR'S NUMBER

NUMBER

OFFENSE OR COMPLAINT:

DIST. NO.

LOCATION:

FLOOR

SQUAD CARS ASSIGNED:

COMPLAINANT:

ADDRESS:

TELEPHONE NO.

DETAILS—DESCRIPTION OF OFFENDER OR OF AUTO, AND DIRECTION IN WHICH ESCAPED:

TIME RECEIVED

A.M. / P.M. _____ 19

BROADCAST BY:

TIME: A.M. / P.M.

TELEPHONED TO:

in the greater number of metropolitan installations the dispatcher is connected by direct wire with each operating position so as to facilitate "cutting in" on extremely important emergency reports. This expedient results in a great saving of time in major emergencies.

The radio dispatcher has at his fingertips the entire resources of the Police Department, and every provision should be made for accelerating their use in the emergency. Maps must be provided, indicating by districts and beats the area patrolled and the distribution of radio-equipped patrol cars. Supplementary devices, either manually or electrically operated, should be used to indicate cars in and out of service, so that the dispatcher may know at all times the number of cars at his disposal.

In the large cities, vast street systems complicate the work of dispatching, and means must be provided to identify quickly the district in which a report originates. In Los Angeles, where there are more than 7500 streets, a satisfactory street-index system has been developed by means of which, it is stated, a total stranger can determine in from fifteen to twenty seconds the radio patrol area in which a certain street and number are to be found. St. Louis attacked the problem in an ingenious manner, under the direction of Sergeant Fisher, in charge of radio communications in that city. This device consists of a large map of St. Louis under plate glass. Stretched tightly across the map are two intersecting wires, and adjoining it is a complete alphabetical list of all streets and alleys in the city. Since the machine is electrically operated, it is only necessary to insert two plugs at the proper point on the alphabetical list, opposite the streets concerned. When this is done, the two wires move and come to rest automatically so that their point of intersection on the map corresponds with the exact point at which the crime report originated. With this device it is possible to determine in a minimum of time the radio patrol area in which the crime, or other disturbance reported, has occurred. The writer recently observed the St. Louis machine in action in a peak

traffic hour. There was much evidence to indicate its worth in reducing the time required for the dispatching operation.

4. *Running time of patrol cars.*—Running time may be defined as the interval, usually in minutes and seconds, between the time of broadcast and the time of arrival of the directed patrol car at the indicated location. It is the generally conceded opinion of police officials that the running time of radio patrol cars must not exceed an average of TWO MINUTES if the radio system is to be considered a paying investment. This opinion, establishing as it does a dead-line operating interval, is fundamentally sound. Where the average running time of any police radio patrol system exceeds a maximum average of two minutes, it may be said that the installation is not providing the service for which it was designed and which it is capable of giving. At the moment that the average running time trespasses beyond this limit, the investment in radio communication equipment tends to become unprofitable.

The reason for this is simple enough. The investment in radio communication facilities is justified by the radical reduction in patrol operating time. It is through radio communication that the probability of apprehension and the preservation of important evidence and witnesses become a direct threat to criminal operations. The necessity for laborious and costly investigations may be eliminated at the outset by the prompt arrest made possible through reduced running time or, as Commissioner Rutledge would say, "by synchronizing the arrest with the depredation." Further, preservation of important evidence and immediate identification of material witnesses expedite the criminal-trial process and reduce the cost of prosecution and conviction.

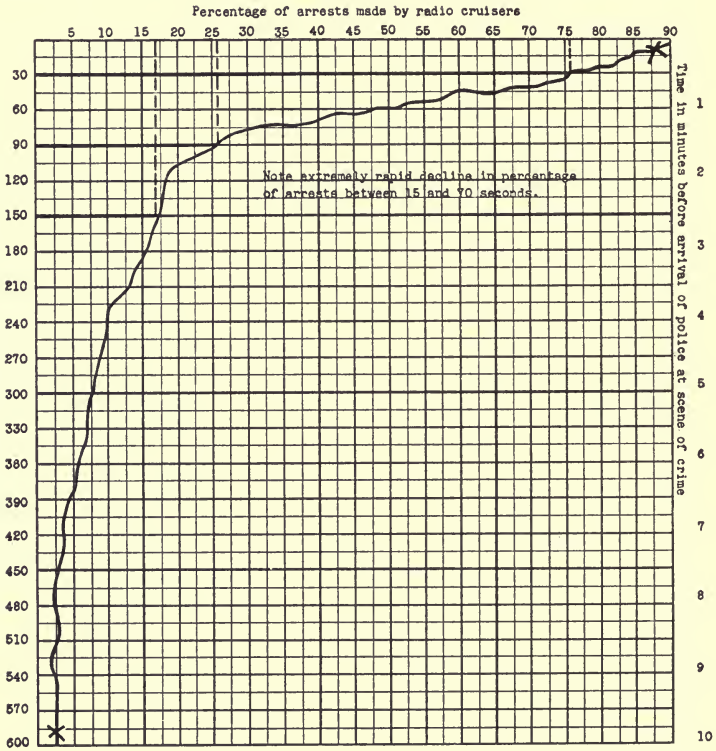
A two-minute time interval is the extreme maximum limit within which these patrol functions may be discharged with any degree of efficiency. If that limit is exceeded, the hazard of escape, destruction or loss of evidence, and disappearance of important witnesses become almost a practical certainty. The running-time interval gives to the criminal his chief margin of safety, but it is also subject to police control.

It is of the greatest importance to state here that any reduction in the running time of patrol cars, even though by fractional seconds, under the established limit increases to a striking degree the probability of a successful run. This is an extremely critical period in respect to patrol strategy and operation. Within this well-defined limit of 120 seconds, any fractional reduction produces an increasingly rapid degree of progression from probable to absolute certainty of arrest as the running time approaches zero.

The significance of every fractional-second approach to zero running time is aptly illustrated by the accompanying chart (p. 168), which was plotted on the basis of arrests made by eight radio patrol cars in a typical 90-day period in Detroit. It will be noted that the curve between ninety seconds and zero is almost perpendicular. For purposes of comparison, there is also presented a similar chart released by the Chicago Police Department covering radio operations in February, 1931. The average values shown are sufficiently above the two-minute deadline to negative, in large measure, the results that should be achieved with this rapid system of communication. Although the performance indicated by this curve is superior to that obtainable through the use of the conventional red-light recall system, it is still far from satisfactory. (Since 1931, it should be stated, the Chicago police radio system has been completely reorganized, with a marked reduction in this time interval.) With a two-minute interval, the radio system is still a serviceable agency, but its energies are a good deal wasted in lost motion and delay.

The area of a radio patrol district bears a definite relation to running time. As in other forms of police patrol, and as determined by the same factors, the area served by a police radio system is divided or decentralized into definite sectors or radio patrol-car beats. There follows, however, from the foregoing discussion, one important additional element. Generally speaking, the dimensions of a radio patrol beat should be such that the distance between any two points within the district may be traversed by an automobile, traveling at an

average of twenty-five miles an hour, in a maximum time interval of two minutes. In downtown business sections and other congested areas, calculations should be made on the basis of an average automobile speed of fifteen miles an hour;



Fractional-second approach to zero running time by radio-equipped police patrol cars: chart plotted on the basis of arrests made by eight cars in a typical ninety-day period in Detroit.

in the less congested residential sections of the city, calculations up to an average speed of thirty miles an hour may be employed. In the intelligent definition of radio patrol district boundaries, the physical topography of the area should be studied and a careful appraisal made of obstructions to travel, such as bridges, narrow streets, and traffic-flow conditions.

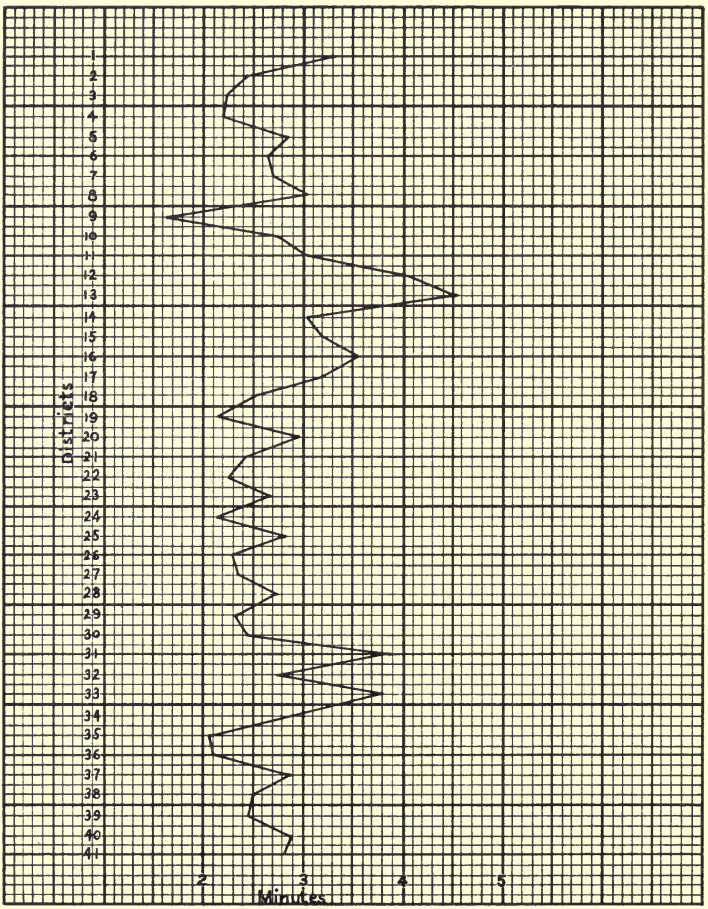
In illustration of the way in which the modern police department is meeting this problem, in eleven Detroit radio districts containing the larger part of that city's population, the average maximum distance that could be traveled in responding to a call for police assistance is 1.44 miles, and the average distance actually traveled is .55 mile. In the other four districts, which are sparsely settled, the average maximum distance is 2.4 miles, and the actual average 1.18 miles. This tabulation refers only to scout cars, and does not take into consideration the cruisers operating in various precincts, which might be anywhere within the area when a call is received. On many calls the cruiser is the first on the scene. The accompanying police map (p. 172) of St. Paul, showing the radio patrol districts, will be helpful in a further study of this problem.

Two distinct systems of radio patrol-car distribution are to be found in the American police field today. The Los Angeles plan is typical of the large metropolitan organization where radio districts are superimposed upon and independent of the regular police-patrol beats. In this system, which is designed for large cities, the radio cars employed are scout cars and cruisers.[4] The scout cars, which are assigned each to a a patrol district, are usually light machines manned by two uniformed policemen. The cruisers are heavy, high-powered cars, equipped with riot guns, tear-gas apparatus, and similar equipment. They carry from three to four plain-clothes patrolmen and detectives, including the driver, and are frequently provided with bullet-resisting windshields and other protective equipment. A given block in the business or residential sections will be patrolled on some occasions by three separate agencies—the scout car, the cruiser, and the beat patrolman. Because of this apparent duplication of patrol services in the larger cities and the effectiveness of the radio patrol system, there is a recognizable tendency among some police departments to reduce the strength of the regular old-line beat patrol force. In Denver and a few other cities this

[4] See page 113.

has further led to the abandonment of substations, since the police radio system makes possible a highly centralized control of the patrol force. Time and experience must determine the full effect of this policy.

The second type of radio patrol organization is illustrated in Berkeley, Calif., where the radio communication system



Performance of radio-equipped police patrol cars in Chicago for one month (February, 1931); service has since been improved. Compare with performance shown in figure on page 168.

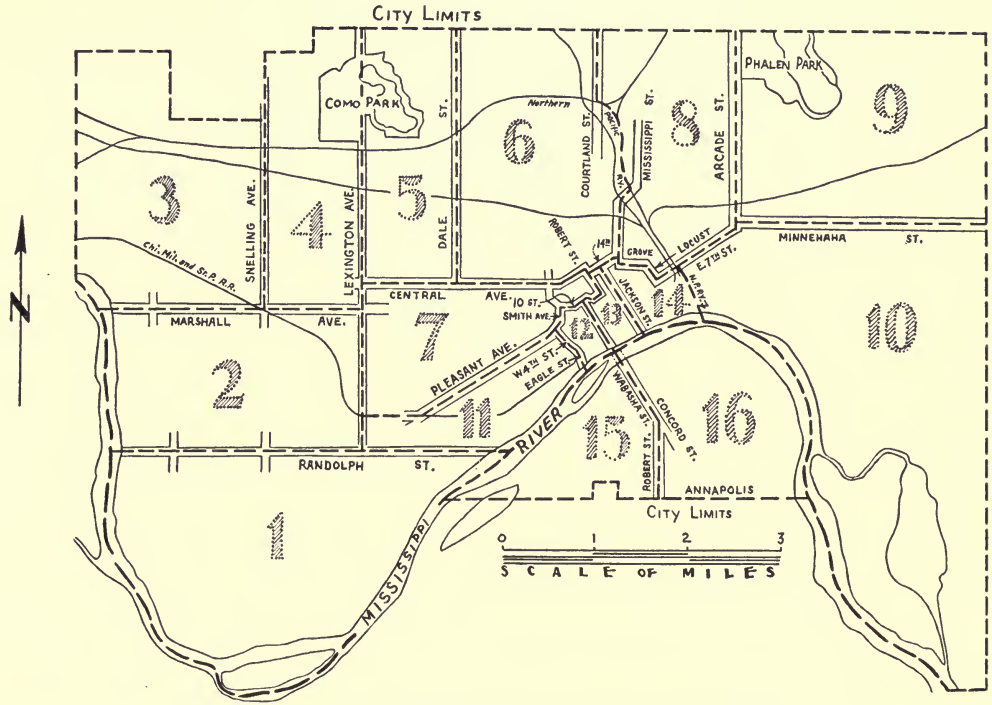
has been harnessed to the regular patrol beat organization. The patrol force in that city was completely motorized when radio communication first entered into police activities. It remained only to equip the patrol cars with radio apparatus in order to bring into existence a highly efficient radio patrol organization. The radio patrol beat and the regular police beat in Berkeley are one and the same. Each radio patrol car is manned by one policeman suitably equipped for emergencies, and performs the functions of both patrol or squad car and cruiser.

In this type of organization, any one beat becomes the center of a larger patrol unit, since the patrol cars in adjacent beats constitute an available reserve force which can be massed or concentrated in the affected area at a moment's notice. Thus speedy protection is available to an entire section of the city, wherever a heavy concentration of the force is necessary. It is never advisable, however, irrespective of the patrol system employed or the nature of the emergency reported, to mass the entire radio patrol strength in one quarter. Some departments do, and the practice affords the opportunity for a favorite ruse of the professional criminal in minimizing the possibility of immediate police interference in the vicinity of an intended attack. Several bank and payroll robberies resulting in heavy losses have been made in several parts of the country by taking advantage of this practice.

Where approximately complete motorization of the patrol force is practicable, this second system of radio patrol more nearly balances economy and efficiency for a city in this population class. With slight modification, it could be adapted to the requirements of the metropolitan area with telling effect.

COLLATERAL DEVELOPMENTS

The expansion of radio communication in the police field has been accompanied by a number of related developments. Chief among these are the police use of the higher frequencies for transmission purposes, the beginning of two-way radio patrol



Map of radio-equipped police patrol-car districts, St. Paul.

communication, and the organization of regional police radio systems; and others include secrecy of communication, and the installation of radio receiving equipment on police motorcycles, airplanes, and boats.

As some of these developments, more particularly the use of high frequencies, two-way communication, and the regional radio system, indirectly resulted from limitation of the number of radio frequency channels available for police use, it is necessary to consider the nature of these limitations.

ALLOCATION OF POLICE FREQUENCIES

Prior to 1924, police officials had given serious thought to police radio use, with the result that, at the thirty-first convention of the International Association of Chiefs of Police, held in that year, it was proposed to petition the Department of Commerce, through the Supervisors of Radio, to set aside a special band of waves in the radio spectrum for the exclusive use of police departments. It was also recommended that a committee of well-informed members be appointed to attend a general radio conference called by Mr. Herbert Hoover, then Secretary of Commerce, and get for the police departments of the United States an allocation of exclusive frequency channels for police transmission. Thus, at this comparatively early date in the history of police radio communication, it was officially recognized that the allocation of specific frequency channels for police operations was an inevitable necessity. No decisive action was taken in 1924, but under the leadership of Mr. Rutledge, then Commissioner of Police at Detroit, and others, the matter of police frequency allocation continued to be a current police problem of major importance.

At the 1929 convention, it was considered imperative that police departments should receive full coöperation from those who controlled the future of radio communication in this country. In view of the huge toll of crime and the cost of law enforcement, police officials felt justified in instructing a new committee to present the matter fully before the Federal Communications Commission. The committee consisted of seven

Michigan Congressmen, one member of the State Senate, the Commissioner of the Department of Public Safety, a lieutenant of State Police, the Highland Park Chief of Police, and Lieutenant Kenneth R. Cox, supervisor of the Detroit police radio station. Mr. Rutledge acted as spokesman.

As a direct result of the work of this committee, the Federal Communications Commission, recognizing both the protective and the entertainment functions of radio communication, issued in April, 1930, General Order No. 85, which officially allocated a total of eight frequency channels to be used entirely for police transmission. The Commission also set up regulations governing the issuing of construction permits and licenses, and further set the maximum amount of power to be assigned to the use of stations in accordance with the populations of the areas served by the respective transmitters.

In the succeeding years the adoption of radio communication by more than one hundred police departments in the United States has lead to a serious congestion in the police frequency band. With the saturation point already at hand, the gravity of the situation becomes apparent when it is stated that there are still more than two hundred and fifty cities ranging in population from 25,000 up that are not yet provided with this valuable form of protection. In 1931, the Law Observance and Enforcement Committee, appointed by former President Hoover, commented as follows:

Although radio in police work is assured a brilliant future, conditions are arising which may become the cause of considerable apprehension. Lieutenant Kenneth R. Cox, of the Detroit Police Department, an outstanding authority in the United States on police radio, in this connection wrote:

"In scanning the figures, which must be considered as representative of the potential magnitude assumed by this vast development, we find that if the situation remains in its present uncontrolled state, the commission will receive applications for approximately 556 police radio stations. We are confronted with an impending chaotic condition that gives promise of paralleling that of the broadcast spectrum before the reallocation of frequencies. In view of this fact, it would seem advisable to anticipate such a condition and introduce precautionary measures that will prevent its occurrence." His suggestions were as follows:

A. That assignments be granted to cities that have urgent need for police radio before assignments are made to smaller municipalities and areas where crime conditions do not warrant immediate introduction.

B. That since the present stations are not existing on the frequency assigned, all be required to maintain frequency to within 100 cycles of the assignment.

C. Since at present the tendency is to establish stations of too great power, that 500 watts, if possible, be the maximum allowed.

D. That a national committee be formed of chiefs of police, who would have authority to determine acceptance or rejection of applications. This would relieve the Federal Radio Commision from the burden of passing on propositions requiring a technical understanding of the problem.

The program of Lieutenant Cox is one which it behooves all police officials to consider seriously. Should the air channels be monopolized by the smaller towns, whose problem cannot be of the same magnitude as the large cities, a very serious check will be placed over the police function in this country.

The Federal Communications Commission has made commendable efforts to escape from this strait jacket. Taking advantage of the size of the United States, the Commission, through a geographical distribution of police frequency assignments, together with a regulation governing the allocation of power to individual stations, has provided an effective control of the country-wide police frequency pattern and transmitting range, and has made possible the use of the eight frequency channels by a hundred or more police departments.

The following representative opinions concerning the problem of power and frequency allocations, especially in view of the inevitable expansion in police communication, have been condensed by the author from a survey recently made among the radio-equipped police departments.

(1) There was more or less general agreement that additional frequency channels should be provided, making possible allocations of power on a more flexible basis, since the limit of power allowable would then be a function of the wave length or frequency.

(2) The more extensive use of the teletype network was recommended, particularly in connection with the work of state-wide police organizations.

(3) It was urged that steps should be taken to have all police stations maintain a tolerance of fifty cycles at their assigned frequency in order to avoid the severe heterodyning between stations from four hundred to two thousand miles distant from the complaining station.

(4) It was realized that the commercial broadcasting station must continue to have the right of way; and the future allocation to police use of bands in the ultra-high-frequency part of the radio spectrum was predicted as the solution of this problem.

(5) The geographical distribution of police frequency assignments, having proved helpful in the past, was recommended for all future plans.

(6) More effective organization of the police departments interested in police radio communication was sought, in order that the problems might be more intelligently attacked.

One Eastern city, with a total area of 316 square miles, considered a frequency of 2450 kilocycles to be satisfactory. Three transmitters were employed to give efficient coverage, one of 500 watts output, and two with 400 watts power each. Interference from outside stations was negligible, and was more particularly noticeable at night, when the messages of the neighboring cities of Rochester and Syracuse, the Bergen County, N. J., police, and Washington, D. C., could be heard. However, no outside signals came in so strong that they could not be overridden by the local signal when the local carrier was placed on the air. A power differential for day-and-night transmission, it was thought, would be a valuable improvement, since reception is much better at night. If the station were permitted to operate with 500 watts power at night, and at 1000 watts output in the daytime, transmission efficiency would be greatly increased and maintenance operations simplified, yet there would be no greater interference in the area affected.

Fortunately, the problem of limited police frequency channels can be solved. Of the various expedients available, two offer the greatest promise of immediate relief, namely, the

organization of regional police communication systems, and the police use of bands in the ultra-high-frequency part of the radio spectrum. The use of ultra-high-frequency channels is here treated first, followed by a consideration of the regional police communication system in Chapter VI.

THE HIGH-FREQUENCY SPECTRUM

The ultra-high frequencies are so called because, when expressed in kilocycles, they run to figures between 30,000 and 400,000 or more, corresponding to wave lengths below 10 meters. These frequencies offer a new field of great promise in establishing communication systems over comparatively small areas. Because of the phenomenal characteristics of signals transmitted in this part of the radio spectrum, definite areas can be very effectively covered, thus making possible the operation on the same frequency of a greater number of transmitters in a given geographical area without the interference that characterizes the channels now employed.

Ultra-high frequencies travel in a straight line, for all practical purposes, in much the same manner as a beam of light given out by a beacon. This means that the distances over which communication is possible are controlled by the height of both the transmitting and the receiving antennae. Small intervening objects, such as buildings, hills, trees, and similar obstructions, however, have no effect upon the transmitted signal: it terminates on the visible horizon. If, for example, the transmitting antenna is placed at a height of 100 feet above ground, the horizon point, or maximum possible transmission range with high-frequency apparatus of the type to be described, would have a radius of 13¼ miles, on the assumption, of course, that the receiving position is directly at ground level. The importance of antenna height in obtaining distance has been demonstrated in tests conducted by the Conservation Department of the State of New York. In these tests, the ultra-high-frequency equipment was installed in a monoplane. When the ship had gained an altitude of 6000 feet, it was possible to communicate signals over a distance of 110

miles. The point with which communication was established was at an elevation of 100 feet above ground.

Ultra-high frequencies also offer the very important advantage of being free from the influence of atmospheric conditions. It was possible to operate throughout a local thunderstorm without interruption. Since adverse weather conditions may be accompanied by increased police activity, the value of this advantage may be readily appreciated. Further, there is no noticeable differential in signal intensity between day and night transmission. As a rule, the signals are as strong at 12 noon as they are at 12 midnight. Fading, dead spots, and skip-distance effect, the enigmas of police broadcast, are reduced to a negligible minimum.

Although the Federal Communications Commission has not as yet allocated any part of the ultra-high-frequency spectrum for commercial services, experimental licenses are being issued for the operation of such stations in order to increase the available knowledge concerning operation in this part of the spectrum. The experimental status of the station continues until such time as the Federal government officially divides this spectrum into channels for the various services.

TWO-WAY RADIO COMMUNICATION

Since the introduction of police radio communication, the apparatus has been much refined. Transmitters have been reduced in size and weight, and their operation so improved that portable equipment can be operated successfully in the field. As a matter of engineering, two-way radio patrol communication presents no particularly serious difficulty at present, and manufacturers now have available portable transmitting equipment specifically designed for police-patrol communication.

Two-way radio communication presages a new era in patrol technique and operation. As a tactical instrument, it represents a radical increase in the available channels of communication between headquarters and the dispersed patrol force, with a corresponding increase in availability of police field

strength. Speed of action, flexibility, and mobility of the force are increased, accompanied by an accelerated interchange of information and instructions in emergencies.

Through the ability of the patrol car to acknowledge immediately the receipt of a message, the control-station dispatcher is assured that his broadcast has been properly received, and that the car or cars assigned are on their way to the scene of the emergency. Furthermore, while proceeding to the scene of action, and up to and including actual contact with the emergency, the motor patrolman may report his progress to the central station and to other motor-patrol units in the area.

Thus the patrolman may directly solicit the assistance of other patrol units in the vicinity, and not lose valuable time by relaying the request for help through the central-station transmitter. Two-way radio communication thus makes mobilization almost instantaneous by increasing the speed with which patrol strength may be concentrated at crucial points.

Conditions change very rapidly in emergencies. Originally reported as a minor disturbance, a situation may suddenly assume the proportions of a felony, and require a speedy exchange of information and orders, with headquarters and with all mobile patrol units in the area. An officer dispatched to a vacant lot on a report that an intoxicated man is lying there, may arrive to find a man brutally clubbed and left to die—"taken for a ride," in gang parlance. Or, officers arriving at the scene of a reported murder may discover the blood-stained body of a woman lying on the bathroom floor, a victim of a fatal lung hemorrhage. Within the space of a few moments, a simple traffic-accident report may involve the entire patrol force in the search for a hit-and-run driver, wanted for manslaughter. A motor-patrol car detailed to the investigation of three suspicious characters loitering in the vicinity, finds a bank robbery under way. On another occasion, "It is murder, not suicide!"—and the man hunt begins.

Examples are legion. The actual facts and circumstances seldom coincide with the original report of information given the department in a hurried call over the telephone for police

assistance. A radio patrolman arriving at the scene of trouble may discover that additional man power is needed to handle the situation. Through direct conversation, he can mobilize immediate assistance, and later, if necessary, divert the flow of help in his direction to highway control points, at the same time directing the central station to get outside departments into action. Thus the patrol operating time is drastically reduced, and in a most flexible manner the motor patrol force, either as individuals or as a unit, functions with a minimum loss of time.

Two separate but related applications of two-way radio patrol communication can be recognized. In one form of organization, only patrol sergeants or other field commanding officers are equipped with portable transmitting apparatus. In emergencies, these officers, by virtue of their localized contact with the situation, may direct the individual patrol cars under their command to the best advantage, maintaining at the same time a direct contact with headquarters. This arrangement represents a special type of decentralization in which, for the duration of the emergency, radio control is temporarily vested in the field commanding officer, subject of course to the receipt of additional instructions and information from the main transmitter at headquarters.

The system employed by the Massachusetts State Police is typical of this first method of control. The transmitter is built into a six-cylinder, one and one-half ton truck, capable of a speed of sixty miles per hour. Transmitting equipment is of the master oscillator type, with a normal power output of 50 watts, and 100 per cent modulated. In operation, it is maintained in zero beat with the main transmitting stations on the frequency of 1574 kilocycles by a receiver-monitor arrangement.

Provisions have been made for setting up the station anywhere. These include a sectional 55-foot mast, a gasoline-driven power supply, and a coil of special cable so that commercial power may be used if within reach. The transmitter has a range of from twenty to twenty-five miles in calling

patrol cars, and will afford two-way communication with the nearest main station from any point in the state. The truck is equipped with riot guns, tear gas, searchlights, and other emergency apparatus.

Operation of this system has proved very successful in localized police actions, such as a man hunt and other operations which attend the commission of violent crimes. The equipment can be sent to the scene, be set up, and serve on the spot as a temporary headquarters, from which may be directed the action of all cruisers detailed to the hunt, without tying up the state-wide radio system of fixed transmitting stations. If some town or community is put out of communication by fire, flood, riot, or other disaster, the truck can be driven into the area and serve as a two-way telephone channel from that area to any of the fixed stations. According to the Massachusetts State Police, the equipment has proved its value on numerous occasions, including that of a disastrous flood in western Massachusetts, and also the well-known McMath kidnaping on Cape Cod in May, 1933.

The police of foreign countries are also making effective use of this innovation in communication. In England, in both London and Nottingham, two-way communication equipment is employed. In Italy and other European countries as well, police two-way radio communication is rapidly assuming major importance in the control and direction of the force.

The Massachusetts equipment is a portable affair, but provision is made for its installation at certain points. Equipment is also now available which will permit broadcast from a moving vehicle, thus eliminating the necessity of setting up an antenna and other equipment at a fixed location. Regardless of the equipment used, it is significant that this first method of two-way communication operation introduces what may be termed the mobile police station, and so temporarily, for the duration of the emergency, decentralizes control of the force.

In the second method of operation, portable transmitters are installed in all patrol car units, or as many as practicable,

making possible a complete two-way communication system between headquarters and all mobile units of the patrol system. The second system may be combined with the first, particularly in emergency situations, in order to facilitate control of the force at the scene.

One manufacturer has made available to police departments a complete installation, comprising all transmitting and receiving equipment necessary for a two-way radio communication system. Main or headquarters station consists of a radio telephone transmitter and a suitable station receiver. Likewise, each of the cruising cars is equipped with both transmitter and receiver. All transmitters and receivers are adjusted to one frequency and are locked in that position. Each cruising unit in the city area is capable of receiving and sending messages from and to the central headquarters station, and communication can be established between moving cars over distances varying between one-half mile and two miles, depending upon the topographical features of the area. Communications are handled by what is known as the simplex method; that is, a switch is provided so that the operator is in either a receiving or a sending position. This may be further explained by reviewing the following example of a typical police call:

BAYONNE HEADQUARTERS, CALLING CAR NO. 4. REPORT POSITION, K.

Operators in all cars are normally required to have their equipment set in the receiving position, which enables them to hear all calls originating either from headquarters or from another car. The instant the operator in car No. 4 hears this call, he waits for the terminating designation, which is the letter "K," then throws his switch to the send position and replies as follows:

CAR NO. 4, REPORTING FROM 16TH STREET AND THE BOULEVARD, K.

This message when received at headquarters can be used either for checking position or for ascertaining the particular car that is nearest to the scene of action. Assuming that car

No. 4 is nearest the scene, headquarters continues the dispatching instructions, which may be of this nature:

CAR NO. 4, PROCEED IMMEDIATELY TO 10TH STREET AND AVENUE C, AUTOMOBILE ACCIDENT REPORTED, K.

Car No. 4, while in motion toward the indicated location, acknowledges the order by sending:

CAR NO. 4 REPORTS RECEIVING ORDER, PROCEEDING TO DESTINATION, K.

Upon reaching 10th Street and Avenue C, the officer finds that an ambulance is urgently needed, so car No. 4 calls headquarters:

CAR NO. 4, CALLING HEADQUARTERS, SEND AMBULANCE AND PATROL WAGON TO 10TH STREET AND AVENUE C, URGENT, K.

Headquarters replies:

O. K. CAR NO. 4, AMBULANCE AND PATROL WAGON BEING SENT OUT IMMEDIATELY, K.

The police ambulance and patrol wagon are at once dispatched to the scene, and car No. 4, after taking care of its regular duties at the scene of the accident, reports back in service for further orders.

The central-station transmitter employed for this installation is similar to the high-frequency transmitter previously described. The mobile-station transmitter has a rated power output of 4.5 watts. Repeated experiments and practical working installations have shown that this power is adequate for almost all mobile applications, whether in police, aircraft, or marine work. The receiver is an extremely sensitive unit and provides loud-speaker reception, except in aircraft installations, in which headphones are used in order to eliminate exterior noise.

With slight changes, this equipment is standard for all police applications. In automobile installations, the control unit, which embodies the loud-speaker, volume control, and control switches, is mounted on the steering post of the car. This places the loud-speaker directly in front of the operator and gives him convenient access to all controls. The rest of the equipment is mounted in the rumble-seat compartment, in the

trunk, or under the dashboard, depending upon the make and model of automobile in which the installation is to be made.

A complete installation of the high-frequency two-way communication system can be made for a fraction of the cost of an ordinary one-way communication system operating on the usual police frequencies. Since the high-frequency spectrum is best adapted to two-way radio communication, manufacturers provide complete installations, including the central-station transmitter, and portable transmitter and receivers for the mobile patrol units. The portable transmitter and car receiver are built into one compact unit.

As an effective instrument for greater patrol efficiency, two-way radio communication is assured a brilliant future in police service. In a recent statement, an internationally known police authority commented upon this new facility as follows: "I have studied the operation of the two-way ultra-high-frequency radio telephone system. This equipment does everything that can be asked for by any police department. In my opinion, the use of two-way radio telephones is inevitable in police work, and within a short time, the present one-way communication systems, which do not permit the police cars to talk back to headquarters, will become obsolete." Police officials in various sections of the country are seriously considering its immediate adoption. Much developmental work has been carried on by the police themselves. By June 1, 1937, the Federal Communications Commission had issued licenses for mobile or portable stations as shown by the list on pages 185–190.

SECRECY IN POLICE OPERATIONS

Secrecy is fundamental to the success of both military and police operations. Premature publication of details connected with criminal investigation has thwarted the police on occasions without number. When radio was adopted as an arm of police communication, secrecy received much serious consideration, since, in radio transmission, information is radiated to all points of the compass. Any person possessing a suitable

STATIONS OPERATING IN THE GENERAL EXPERIMENTAL SERVICE AS MUNICIPAL POLICE STATIONS

Call letters	Licensee	Transmitter location fixed	Number mobile or portable	Power (watts)	Frequency (kc.)*
W6XKW	City of Alameda	Alameda, Calif.	(7)	50	2
W6XFE	City of Alhambra	Alhambra, Calif.	(9)	50	2
	City of Ann Arbor, Mich.	None	(4)		
W6XMW	City of Arcadia	Arcadia, Calif.	(2)	50	1
W3XBD	City of Atlantic City	Atlantic City, N. J.	(11)	50	6
	City of Auburn, N. Y.		(5)		
W3XGL	City of Baltimore, Md.	Mobile	(1)	6	1
	City of Bay City, Mich.	Mobile	(6)	15	1
W2XCJ	City of Bayonne	Bayonne, N. J.	(9)	25	1
	City of Beaumont, Tex.	Mobile	(4)		
W2XIF	Borough of Belmar	Belmar, N. J.	(1)	25	4
	Bergen County, N. J.	Mobile	(4)		
	City of Berkeley, Calif.	Portable-mobile	(3)		
W3XBA	City of Bethlehem	Bethlehem, Pa.	(6)	25	6
W6XID	City of Beverly Hills	Beverly Hills, Calif.	(12)	50	1
	City of Birmingham, Ala.	Mobile	(2)		
	Town of Bloomfield, Conn.	Portable-mobile	(5)		
W1XAO	City of Boston	Boston, Mass.	(78)	1500	1 plus 35600
W1XAX	Town of Brookline	Brookline, Mass.	(7)	50	6
	City of Buffalo, N. Y.	Mobile	(6)		
W6XJK	City of Burlingame	Burlingame, Calif.	(7)	50	1
	State of California Dept. Motor Vehicles, Calif. Highway Patrol	Portable-mobile	(2)		
W1XCE	City of Cambridge	Cambridge, Mass.	(7)	50	1
W8XAQ	City of Canton	Canton, O.	(11)	5	1
W9XIE	City of Cape Girardeau	Cape Girardeau, Mo.	(1)	30	2 & 5
W9XHX	Carondelet Township	Carondelet Township, Mo.	(2)	50	2 & 3
	City of Cedar Rapids, Ia.	Portable			
W9XGD	City of Chicago Heights	Chicago Heights, Ill.	(4)	15	1
W8XCP	City of Cleveland	Cleveland, O.	(12)	100	1
	County of Cleveland, Okla.	Mobile	(3)		
W4XBN	City of Clinton	Clinton, S. C.	(1)	8	1
	Town of Cohasset, Mass.	Mobile	(1)		
W3XFG	Borough of Collingswood	Collingswood, N. J.	(2)	25	1
W6XOR	County of Contra Costa	Martinez, Calif.	(6)	250	3
W2XIX	Township of Cranford	Cranford, N. J.	(3)	15	1
	City of Cranston, R. I.	Portable-mobile			
	City of Dallas, Tex.	Mobile	(2)		
W1XE	Town of Darien	Darien, Conn.	(2)	15	1
W8XAE	City of Dayton, O.	Mobile	(1)		
W2XDD	Borough of Deal	Deal, N. J.	(4)	20	6
W8XAO	City of Dearborn	Dearborn, Mich.	(1)	50	1

* (1) 30100, 33100, 37100, 40100.
(2) 30100. (3) 33100. (4) 37100. (5) 40100.
(6) 30100, 33100, 37100, 40100, 86000, to 400000, 401000 and above.

STATIONS OPERATING IN THE GENERAL EXPERIMENTAL SERVICE AS MUNICIPAL POLICE STATIONS—*Continued*

Call letters	Licensee	Transmitter location fixed	Number mobile or portable	Power (watts)	Frequency (kc.)*
	City of Des Moines, Ia.	Portable-mobile	(3)		
W8XBB	City of Detroit	Detroit, Mich.	(8)	150	1
	Metropolitan Police Dept., District of Columbia	Portable-mobile	(2)		
	County of Douglas, Kan.	Mobile	(1)		
W9XEC	Dupage County	Wheaton, Ill.	(1)	300	4
W2XCT	Town of Eastchester	Eastchester, N. Y.	(2)	25	6
W2XKJ	City of East Orange	East Orange, N. J.	(6)	50	1
W9XIY	City of Elgin	Elgin, Ill.	(5)	50	3
W2XQ	City of Elizabeth	Elizabeth, N. J.	(9)	25	6
W9XDN	City of Elmhurst	Elmhurst, Ill.	(1)	30	4
	City of El Paso, Tex.	Portable-mobile	(4)	25	1
W5XAC	City of Enid	Enid, Okla.	(2)	5	1
W9XNA	City of Evanston	Evanston, Ill.	(11)	50	1
W9XEH	City of Evansville	Evansville, Ind.	(6)	50	2
W1XEW	City of Everett, Mass.	Portable-mobile	(6)	15	1
	City of Fall River, Mass.	Portable-mobile	(6)	15	1
W2XKZ	Borough of Fanwood, N. J.	Portable-mobile		9	1
	City of Flint, Mich.	Portable-mobile	(11)	10	1
W4XCK	State of Florida. State Road Dept.	Portable		1000	1
	City of Fresno, Calif.		(6)	15	4, 5
W2XMA	Incorporated village of Garden City	Garden City, N. Y.	(6)	35	4
W9XKP	City of Gary	Gary, Ind.	(6)	75	1
W2XMS	Town of Greenburgh	Greenburgh, N. Y.	(3)	50	1
W8XIS	City of Grosse Pointe	Grosse Pointe. Mich.	(4)	5	1
W8XJA	Township of Grosse Pointe	Grosse Pointe, Mich.	(12)	10	2
W8XF	City of Hamilton	Hamilton, O.	(6)	150	1
W9XCS	City of Hammond	Hammond, Ind.	(13)	100	1
W3XBJ	City of Harrisburg	Harrisburg, Pa.	(5)	25	1
W2XGK	Town of Harrison	Harrison, N. Y.	(6)	50	6
W1XHC	City of Hartford	Hartford, Conn.	(2)	150	1
W8XBQ	City of Highland Park	HighlandPark, Mich.	(7)	50	1
W1XFQ	Town of Hingham	Hingham, Mass.	(2)	30	4
W5XBO	City of Houston	Houston, Tex.	(6)	50	1
W1XDW	Town of Hull	Hull, Mass.	(6)	10	4
W2XFA	City of Jersey City, Dept. of Public Safety	Jersey City, N. J.	(33)	100	1, 2, 3, 31900
W9XMM	City of Joliet	Joliet, Ill.	(3)	15	3
W9XCA	City of Kansas City	Kansas City, Kan.	(22)	100	1
	City of Kansas City, Mo.		(31)	7.5	1
W2XGP	Borough of Kenilworth, Ill.	Portable-mobile		.5	1
W9XJJ	Village of Kenilworth	Kenilworth, Ill.	(1)	5	2

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STATIONS OPERATING IN THE GENERAL EXPERIMENTAL SERVICE AS MUNICIPAL POLICE STATIONS—*Continued*

Call letters	Licensee	Transmitter location fixed	Number mobile or portable	Power (watts)	Frequency (kc.)*
	City of Kokomo, Ill.	Mobile	(4)	7.5	3
	Department of Metropolitan Police, Lafayette, Ind.	Mobile	(2)	5	1
W9XQQ	Lake County Sheriff's Office, City of Lake Forest, Ill.	Mobile	(6) (1)	10 5	1 1
W9XOY	City of Lasalle	Lasalle, Ill.	(2)	100	1
	County of Lasalle, Ill.	Mobile	(3)	35	1
W9XMR	City of Lawrence	Lawrence, Kan.	(2)	16	2
	City of Leavenworth, Kan.	Mobile	(1)	5	6
W6XEH	City of Long Beach	Long Beach, Calif.	(13)	100	1
W2XJP	City of Long Branch, Dept. of Public Safety	Long Branch, N. J.	(6)	50	1
W3XFB	Borough of Longport	Longport, N. J.	(2)	25	6
	City of Los Angeles, Calif.	Mobile	(4)	100	1
W6XPA	Sheriff's Department, Los Angeles County, Calif.	Belvedere Dist., Calif.	(11)	15	1
W1XDT	City of Manchester	Manchester, N. H.	(5)	50	1
	Commonwealth of Massachusetts, Dept. of Public Safety		(10)	100	1
W1XLA	Metropolitan District Commission of the Commonwealth of Massachusetts	Boston, Mass.	(8)	500	4
W1XBY	City of Medford, Mass.		(6)	15	2
W6XFY	City of Merced, Police Dept.	Merced, Calif.	(1)	15	4
	City of Miami, Fla.	Mobile	(13)	16.5	2
W4XG	City of Miami Beach	Miami Beach, Fla.	(3)	50	1
W2XHQ	Township of Millburn	Millburn, N. J.	(3)	30	1
W6XDL	City of Modesto	Modesto, Calif.	(3)	100	1
W8XFH	City of Monroe	Monroe, Mich.	(2)	35	3
W6XHR	City of Monrovia, Police Dept.	Monrovia, Calif.	(2)	12	1
W3XET	Town of Morristown	Morristown, N. J.	(2)	5	1
W8XLB	City of Muskegon, Mich.	Mobile		15	2, 3, 5
W4XAU	City of Nashville	Nashville, Tenn.	(11)	50	1
	City of New Brunswick, N.J.	Portable-mobile	(5)	15	1
W1XFH	City of New London, Conn.		(1)	10	2
W2XKR	City of New York	New York, N.Y.	(1)	17	4
W3XDA	Borough of North Plainfield	Plainfield, N. J.	(2)	25	1
W1XHY	Town of Norwood	Norwood, Mass.	(1)	20	1
W2XLV	Town of Nutley Police Dept.	Nutley, N. J.	(3)	25	1

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STATIONS OPERATING IN THE GENERAL EXPERIMENTAL SERVICE AS MUNICIPAL POLICE STATIONS—*Continued*

Call letters	Licensee	Transmitter location fixed	Number mobile or portable	Power (watts)	Frequency (kc.)*
	Village of Oak Park, Ill.	Mobile	(12)	15	2
W6XIA	City of Oceanside	Oceanside, Calif.	(2)	2.5	3, 4
	State of Ohio	Mobile	(4)	25	1
	City of Oklahoma City, Okla.	Portable-Mobile	(3)	.5	3
	County of Oklahoma, Okla.	Mobile	(3)	25	1
	City of Omaha, Neb.	Mobile	(2)	5	1
	City of Ontario, Calif., Police Dept.		(2)	10	1
W6XGM	County of Orange, Calif.	Portable-mobile	(1)	4.5	1
W9XIG	City of Ottawa	Ottawa, Ill.	(2)	100	1
W6XLC	Palm Springs Police Protection Dist.	Palm Springs, Calif.	(1)	36	1
W9XPA	City of Park Ridge	Park Ridge, Ill.	(2)	15	1
	City of Pasadena, Calif., Police Dept.		(13)	100	1
W9XBA	Peoria Police Dept.	Peoria, Ill.	(13)	100	6
W9XGC	City of Peru	Peru, Ill.	(1)	50	1
W6XJU	City of Petaluma	Petaluma, Calif.	(2)	10	3, 4
	City of Philadelphia, Pa.		(3)	10	5
W6XQK	City of Phoenix, Ariz., Police Dept.	Portable-mobile		10	2
W6XBF	City of Piedmont	Piedmont, Calif.	(7)	500	3
	City of Piedmont		(5)	5	1
W2XFU	City of Plainfield	Plainfield, N. J.	(5)	25	6
W1XLW	Town of Plymouth Police Dept.	Plymouth, Mass.	(2)	40	1
W8XEP	City of Pontiac	Pontiac, Mich.	(8)	50	3
W2XAJ	City of Port Jervis, N. Y.		(1)	.5	2, 3
	City of Portland, Ore., Dept. of Public Safety		(6)	10	1
W2XGC	City of Poughkeepsie, N.Y.		(1)	100	1
W3XFZ	Borough of Princeton	Princeton, N. J.	(2)	15	4.5
W1XEO	City of Providence, R. I.		(1)	7.5	2, 5
W1XBL	City of Quincy Police Dept.	Quincy, Mass.	(8)	150	1
W9XLS	City of Racine Police Dept.	Racine, Wis.	(7)	25	1
W2XNK	City of Rahway	Rahway, N. J.	(3)	5	5
W4XCE	City of Raleigh	Raleigh, N. C.	(25)	25	1
W9XB	Village of River Forest	River Forest, Ill.	(4)	100	5
W9XPF	City of Rochester	Rochester, Minn.	(1)	5	1
	City of Rockford, Ill.		(2)	10.5	1
W2XIJ	Rockland County	New City, N. Y.	(22)	250	1
W2XEN	Borough of Roselle	Roselle, N. J.	(2)	25	2, 3
W2XOL	Village of Rye	Rye, N. Y.	(6)	25	1

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STATIONS OPERATING IN THE GENERAL EXPERIMENTAL SERVICE AS MUNICIPAL POLICE STATIONS—*Continued*

Call letters	Licensee	Transmitter location fixed	Number mobile or portable	Power (watts)	Frequency (kc.)*
W6XLR	City of Sacramento, Calif., Police Dept.	.....	(1)	10	1
	City of Saginaw, Mich.	.....	(16)	10	2
W9XQI	City of St. Charles Police Dept.	St. Charles, Mo.	(1)	15	2
W9XKC	City of St. Joseph	St. Joseph, Mo.	(12)	50	3
	St. Louis Metropolitan Police Dept.	.....	(7)	15	3
W1XEL	City of Salem	Salem, Mass.	(2)	25	1
W4XAC	City of Salisbury	Salisbury, N. C.	(2)	20	1
	Salt Lake City Corporation	.....	(6)	10	2
W6XHG	Town of San Anselmo	San Anselmo, Calif.	(3)	5	1
W6XHE	City of San Bernardino, Calif.	.....	(1)	10	3
	City of San Buenaventura, Calif.	.....	(4)	10	2
	City of San Diego, Calif.	.....	(28)	12	1
W6XGC	City of San Gabriel	San Gabriel, Calif.	(3)	50	1
W6XKR	City of San Mateo	San Mateo, Calif.	(2)	5	1
	City of Santa Barbara	.....	(6)	7	2
W6XHO	City of Santa Rosa	Santa Rosa, Calif.	(2)	10	1
W1XFT	Town of Scituate	Scituate, Mass.	(2)	20	4
W8XEC	City of Scranton Police Dept.	Scranton, Pa.	(4)	100	1
W2XKW	Town of Secaucus	Secaucus, N. Y.	(2)	15	1
W1XOU	Town of Sharon	Sharon, Mass.	(1)	5	3
W6XLE	City of Signal Hill	Signal Hill, Pa.	(1)	4.5	1
W9XGE	City of Sioux Falls	Sioux Falls, S. D.	(1)	7.5	1
	City of Spokane	.....	(9)	10	1
W9XOV	City of Springfield	Springfield, Ill.	(2)	50	1
W1XHM	City of Springfield	Springfield, Mass.	(10)	50	3
W8XBT	City of Springfield	Springfield, O.	(12)	50	1
W9XIH	City of Streator	Streator, Ill.	(1)	100	1
W6XIZ	City of Syracuse, N. Y., Dept. Public Safety	Mobile	(1)	5	1
	City of Tacoma, Wash., Police Dept.	.....	(6)	5	1
W4XDG	City of Tampa, Fla.	Mobile	(1)	16.5	1
W9XHG	City of Terre Haute	Terre Haute, Ind.	(1)	25	1
W3XEK	City of Trenton	Trenton, N. J.	(12)	100	1
	City of Tulsa	.....	(7)	15	1
W6XGG	Turlock Police Dept.	Turlock, Calif.	(2)	5	1
W5XBI	City of Tyler	Tyler, Tex.	(5)	30	3, 4
W2XHW	Township of Union	Union, N. J.	(3)	7.5	5
W2XCA	City of Union City	Union City, N. J.	(5)	25	6

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STATIONS OPERATING IN THE GENERAL EXPERIMENTAL SERVICE AS MUNICIPAL POLICE STATIONS—*Concluded*

Call letters	Licensee	Transmitter location fixed	Number mobile or portable	Power (watts)	Frequency (kc.)*
W8XIX	City of Utica, N. Y.	.....	(1)	10	2, 3
W3XF	City of Ventnor City	Ventnor City, N. J.	(3)	25	
W2XJK	Borough of Verona	Verona, N. J.	(2)	50	1
W6XFZ	City of Visalia	Visalia, Calif.	(2)	10	4
W9XPO	City of Waukegan	Waukegan, Ill.	(3)	15	3
W2XIO	Town of Westfield	Westfield, N. J.	(3)	25	1
W2XJA	Town of West New York	West New York, N. J.	(5)	25	5
W9XDQ	City of Wheaton	Wheaton, Ill.	(2)	25	3
W8XGE	City of Wheeling	Wheeling, W. Va.	(3)	50	1
W9XJD	City of Whiting	Whiting, Ind.	(2)	15	1
	City of Wichita, Kan.	.....	(24)	4.5	1
	City of Wichita Falls, Tex.	.....	(2)	8	2, 4, 5
W8XLV	City of Williamsport	Williamsport, Pa.	(2)	25	2
W2XIC	Township of Woodbridge	Woodbridge, N. J.	(3)	25	1
	City of York, Pa.	.....	(2)	25	1
W8XIF	Ypsilanti Police Dept.	Ypsilanti, Mich.	(2)	35	1

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receiver might listen to police broadcasts. The probability that criminals would exploit this opportunity to their advantage was obvious.

In the early use of radio in law enforcement, many police officials viewed the problem with anxiety. At the 1924 convention of the International Association of Chiefs of Police, a committee was appointed to prepare a suitable code for police use, in order that information might be transmitted without the possibility of its being intercepted and used for criminal purposes.

The story has been frequently told of an apartment-house burglar in Chicago who had taken the precaution to tune the receiver in the apartment to the police broadcast frequency. Neighbors reported to the police their suspicions of a burglary and the radio dispatcher immediately went on the air with an alarm broadcast, "Burglar operating in apartment on sixth floor at 5364 Main Street," and ordered squad cars to the scene. Hearing the message, the burglar is said to have

written a note of thanks for the warning, pinned it on the radio, and made a leisurely departure before the officers arrived.

The police were hard pressed for a solution to this apparent problem. Some departments began their radio operations with the use of telegraphic radio transmission instead of voice broadcast. This method is still employed in a large degree in foreign police radio systems, particularly in Europe, where the patchwork of international boundary lines conspires to make greater the need for secrecy.

In addition to the secrecy inherent in a coded message, there were other advantages in the use of a radio telegraph transmitter. Telegraphy is more accurate than telephony. A word written down, as it invariably is with telegraphy, usually has only one meaning; in a telephonic message, two words sounding alike may carry different meanings. The same difficulty applies to numerals, as, for example, in transmitting an automobile license number or a street address. With telegraphy, the operator has a definite and continual check on a plain language message as he writes it down. In telephony it is often necessary to spell difficult words letter by letter. Nine times out of ten, for example, the word "ink" will not be understood unless sent in the following manner: "I" for Isaac; "N" for Nellie; "K" for King. Further, with a given total power input, the cost of telephone transmission, which possesses only 25 per cent of the range of a telegraph transmitting station, would be 20 per cent higher than that of the telegraph transmission. The maintenance cost of a telegraph transmitter is also somewhat lower than that of the telephone set, since the latter requires more complicated apparatus.

Telegraphy thus has several advantages over speech broadcast; nevertheless, voice transmission, so far as police service is concerned, possesses the cardinal virtues of simplicity and speed in actual operation, and it has become the universal practice in this country to use speech broadcast in the control of radio patrol cars.

Secrecy obtainable in voice broadcast.—Any form of com-

munication is adaptable to code methods. In police service, it is a simple matter to code streets, numbers, crime classifications, and other information so as to avoid detection. Several departments have developed suitable codes for this purpose. In 1933, the city of Milwaukee had three milk strikes. The seriousness of the situation may be appreciated when it is realized that Milwaukee receives from 550 to 600 truckloads of milk daily from the surrounding territory. It was found that strikers were equipped with short-wave receivers tuned to the police frequency and this, according to the sheriff, made it very difficult to cope with the situation in the first strike. In the second and third strikes, a code was used, based on a numerical assignment to strategic highway points. The numbers were reversed daily and the necessary secrecy in messages to deputy sheriffs patrolling the highways was successfully secured. Thus far, however, the use of the code system has been rather limited because there is a small additional interval of lost time in the coding and decoding of messages. To that degree, coding defeats the all-important purpose of a police radio system, namely, the reduction of delay. In an emergency, time is the vital factor and no operation should be admitted into the communication procedure which increases the operating-time interval.

For the solution of this problem, should it eventually assume serious proportions, the police are depending upon the radio engineer. In the process of transmission, it is possible to transpose and alter current values from the speech input system and modulation stage so that the message will be unintelligible when received with an ordinary receiver, even though tuned to the carrier frequency. This method is sometimes referred to as "scrambling" and involves the use of a specially designed receiver, rather elaborate and costly in construction and installation. Both military authorities and the police have thus far found this solution impractical.

Virtually absolute secrecy in voice broadcast may be obtained through the use of a transmitter in which a low radio frequency is impressed on the carrier wave, resulting in a het-

erodyne effect. The beat frequency is then modulated by the regular speech input system. In other words, the transmitter continues to operate on its assigned frequency of, say 2,422 kilocycles per second, in accordance with the Federal license authorizing its operation. The licensed carrier frequency, however, is not modulated directly by the energy received from the speech input system; on the contrary, it is affected by a superimposed lower radio frequency resulting in a heterodyne beat note or secondary carrier wave which carries the audio frequency variations. This is known as the double modulation system, and it is impracticable, if not altogether impossible, for an outside receiver to detect the conversation; the receiver may tune in on the primary carrier frequency, as in ordinary reception, but for all practical purposes the speech modulation is inaccessible. Police cars may receive the conversation without difficulty if equipped with proper receiving apparatus. According to military authorities, one of the surprising by-products of this system is the almost complete absence of static and other interference usually encountered in radio reception. Here again, however, elaborate and costly receiving equipment is required.

It is believed, nevertheless, that the engineering approach to the problem of secrecy offers greater promise than any other method, so far as the control of police patrol cars is concerned. Police communication officers interested in this phase of police broadcast should not overlook the resources and accomplishments of the United States Signal Corps in this field. With respect to both code and specially designed equipment, this force of able men has made many significant contributions to secret communication.

Secrecy not absolutely essential.—So far as the records indicate, only in rare and isolated instances has the absence of secrecy in police broadcast defeated the purposes of police radio patrol. Some departments are of the opinion that systems providing a measure of secrecy are desirable if they are mechanical in principle, rather than patterned along code lines.

However, there is a growing sentiment among police officials generally that the number of times that police transmissions are used for improper purposes is far outweighed by the salutary effect of widespread reception by the general public. In support of the opinion that secrecy in police broadcast is not a pressing problem at the present time, it should be pointed out that public reception of crime alarms has given the community a new conception of the police department, its responsibilities and its operation. A collateral result has been a marked increase in the number of persons reporting crimes and other irregularities to the police, who would otherwise have kept silent. Many police officials are inclined to regard this situation as decidedly advantageous to the police department.

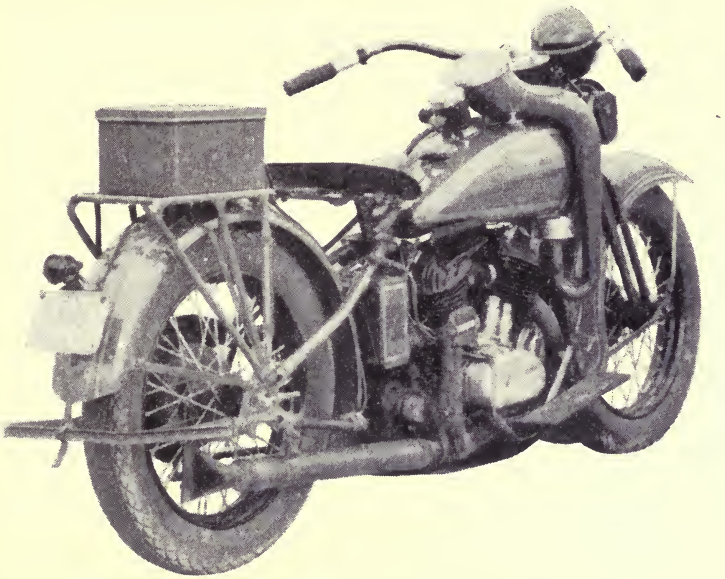
In view of the revolutionary changes that occasionally take place almost overnight in radio equipment and technique, it is entirely possible that new uses and applications in the police field will create a greater future need for communication secrecy. Conceivably, changes in the conditions affecting law enforcement may also bring this about. With the demand, however, will come an engineering solution to the problem which will afford the secrecy that may be necessary to defeat criminal detection of the police message.

THE RADIO-EQUIPPED MOTORCYCLE

Manufacturers of motorcycles in this country have kept abreast of the times in developing radio receiving equipment which could be operated successfully on both solo motorcycles and side-car machines. With the side-car or tandem arrangement the receiver is usually mounted in the side car just to the rear of the passenger's seat cushion. The loud-speaker unit is installed directly on the tank of the motorcycle between the handle bars, so that its volume is directed toward the driver. On the solo machine, the receiver is mounted on a luggage carrier to the rear of the driver.

Motorcycle radio equipment.—Standard automobile receivers with slight modifications may usually be adapted to use

on motorcycles, although manufacturers are now placing on the market receiving equipment specifically designed for motorcycle installations. Clear daylight reception at speeds of from thirty to forty miles per hour, within a radius of from 15 to 20 miles of a 400-watt station, is regular performance. With a less powerful station, the effective service radius is natur-



Motorcycle for police use, equipped with a short-wave radio receiving set.

ally somewhat reduced. At many stations, satisfactory daylight reception has been obtained over distances of 50 miles or more. With this equipment, broadcast can easily be heard above the noise of downtown traffic.

A few of the departments employing radio-equipped motorcycles in patrol operations are Des Moines, Iowa; Davenport, Iowa; Milwaukee City and County, Mich.; Omaha, Neb.; San Francisco, Calif.; Dallas, Tex.; Fort Worth, Tex.; Waco, Tex.; Beaumont, Tex.; El Paso County, Tex.; Birmingham, Ala.; Santa Barbara, Calif.; Arizona Highway Patrol, Washington State Patrol, and Kansas City, Mo.

In most of these cities, radio-equipped motorcycles supplement the work of the regular radio patrol cars. As a rule, the area is divided into motorcycle patrol zones, with one machine assigned to each zone. The primary duties of radio motorcycle patrols are the observation of traffic and the investiga-

Radio-equipped motorcycle and side-car unit with armored construction. Shields fold down while officers are on patrol duty. Note handles which may be pulled quickly to snap shields into place. Shields are equipped with bulletproof glass and provided with portholes for barrels of revolvers or shotguns.

tion of all automobile accidents. In one city, two machines are assigned exclusively to what is known as the Wreck Investigation Squad. Motorcycle officers are also frequently used in crime emergencies where a rapid concentration of police strength is required.

RADIO-EQUIPPED POLICE PLANES AND BOATS

The strategic value of the airplane in police service is easily recognized. As a speedy observation and pursuit unit, it provides the police with a new force in the detection and sup-

pression of crime. The possibility of aerial police was first officially recognized in June of 1914, when Chief C. E. Sebastian, then Chief of Police at Los Angeles, Calif., recommended, on the floor of the twenty-first annual convention of the International Association of Chiefs of Police, that the use of airplanes be extended to police service in both urban and rural areas. He drew attention to the performance of the United States marines and soldiers at Vera Cruz, Mexico, a short time before, in which their aerial units were employed with telling effect. Airplanes dispatched from Vera Cruz circled over the camp of the Mexican Federals, photographed them and their entrenchments, obtained valuable and accurate maps of roads, trails, and streams, and returned safely to headquarters, all within a short period of time. Giving his recommendations a local application, he cited two California instances wherein police planes would have been of great assistance to the police and the sheriff's men in the pursuit of bandits. In one instance, the bandits escaped into the desert and were captured after three days; in the other, they were never caught. In both affairs, the use of the airplane would almost certainly have assured speedy capture.

In 1914, communication was very different from communication in 1925. Chief Sebastian was hard-pressed for some form of communication between the plane and the ground force. In signaling to and from mobile units at that time, some type of visual or audible system was necessary. With the telephone and telegraph, both sending and receiving terminals were anchored to fixed points, with land wires as the transmitting medium. Radio was just beginning its spectacular career of development in military service at the outbreak of the World War, and had not yet reached the stage where communication with mobile units was a practical affair. The Chief summed up the communication problem with the statement: "With the wigwag or other signaling device he [the aviator] could easily communicate with pursuers trailing a fugitive along the highways or streets, and effectively direct their movements."

Today, radio telephone conversation between planes, and between plane and ground force, either at fixed points or in cruising cars, is an accomplished fact. In February, 1931, Edward P. Mulrooney, Police Commissioner of New York City, was sitting in his office at headquarters. A. W. Wallander, a captain of police, was cruising over the city at an altitude of 2000 feet.

"What do you see?" asked Mr. Mulrooney.

"Miles of waterfront and plenty of motor traffic," replied Captain Wallander. "It is beginning to snow up here," he added.

It was necessary to convince the officials gathered together for the demonstration that the Captain was not speaking over conventional telephone lines. The experiment gave official sanction to the already established fact, that a flying policeman might telephone to headquarters as easily as the policeman on the beat.

Whatever the form of transportation, radio communication, with its elimination of land wires, provides a flexible and sure means of contact with the mobile unit. For several years, two-way radio telephone has been employed for dispatching and directing the movements of mail and passenger planes. With respect to the engineering problems, model equipment is now available for two-way communication with all aircraft. Radio transmitters and receivers for use in aircraft have been developed by several manufacturers.

Since in air-mail and passenger service, continuous two-way communication at all times is required and since the principal airports of the United States are about 200 miles from each other, a reliable communication range of about 100 miles is required of equipment designed for aircraft service. Range of this distance can be obtained through the use of ground-station transmitters of at least 400 watts power and aircraft transmitters of at least 50 watts power, both completely modulated. In radio telegraphy, because of the greater ease with which code messages can be received through static, noise, and other interference, 200 watts of power is sufficient for

ground-station use and 20 watts for aircraft transmitters. Recent developments in high-frequency radio communication equipment will undoubtedly result in a substantial decrease in the power required at both the fixed and the mobile aerial stations.

Modern conditions confronting the police have opened up a promising opportunity for the radio-equipped airplane in police service. Mobs and other large-scale movements in a city can be watched and the operations of the police directed in accordance with reports from aircraft observers who have the advantage of a bird's-eye view. Problems that involve the regulation and control of traffic in large cities, when seen in broad perspective more readily lend themselves to intelligent solution. In the pursuit of escaping fugitives, Chief Sebastian's dream becomes a reality, for officers cruising overhead at from eighty-five to two hundred miles an hour may converse directly with the ground force and effect a rapid concentration of motor patrol units at crucial points. Augmented and equipped with powerful searchlights, aerial observation becomes almost as practical by night as during the day. In times of disaster, the radio-equipped plane has no competitor in making a swift and accurate survey of the territory affected. The observer, constantly in direct two-way communication with headquarters, through his reports and instructions provides an intelligent basis that makes possible the most effective distribution of the force and its equipment.

The New York City Police Department now has an organized police air force, and the departments of many other cities are prepared to place observers in the air at a moment's notice. The airplane is rapidly coming within the price range of the automobile and the time is not far distant when the cost of a flying unit suitable for police work will be comparable to that of a satisfactory motor car. This will be an important factor in extending its sphere of practical usefulness in police service.

Where departments are unable at the present time to purchase and maintain this type of equipment, arrangements

may easily be made in advance for its use in emergencies. Airports are so numerous today as to be almost without number. Virtually every city in the country has within or near its boundaries one or more municipal or commercial landing fields, where will be found every type of flying equipment. Police departments, particularly in the larger communities, should undertake negotiations with the owners of radio-equipped planes, so that one or more units may be pressed into service without delay when the occasion arises. The greater number of our police departments already include among their personnel, officers who are licensed pilots and experienced observers. All departments should have one or more such officers.

In the radio control of police boats, no serious engineering problem is presented. Two-way radio communication with vessels at sea was a practical affair even before 1910, and maritime radio communication has now for some time been an accomplished fact. In cities situated near large harbors, rivers, or lakes, where fast boats afford the criminal additional avenues of operation and escape, suitably equipped police boats are maintained. These craft are in constant communication with headquarters and are therefore immediately available for any emergency service. Radio installations aboard police boats are of course governed by maritime regulations, which apply to the use of radio on any vessel afloat. In New York Harbor, San Francisco Bay, Puget Sound, and numerous other places, the radio-equipped police boat is daily performing a distinct service in law-enforcement activities.

LOOKING INTO THE FUTURE

It is difficult to consider the remarkable strides of police communication in the past six years without realizing the astonishing influence that radio communication has already exerted upon modern patrol methods and technique in a remarkably short time. It cannot be doubted that further sigficant advances in the radio control of patrol operation are to be expected in the near future.

Fundamental research of all types is moving forward. The abstract discovery of today is the practical contribution of tomorrow. The basic science of electromagnetic radiation and the dependent applied science and technique of radio communication are likely to undergo even more notable developments. Radio communication has not yet reached the peak of its power or usefulness.

At the present time, many new devices and methods stand at the threshold of practical communication in police service. Reduction in the size and weight of transmitters and receivers has made it possible for the patrolman to include his radio, along with baton, revolver, flashlight, and handcuffs, as part of his personal equipment. In England, the individual officer is now equipped with a transmitting and receiving equipment that is variously known as the "Sam Browne," or the portable or pocket radio. Several departments in this country are now experimenting with it.

Development of the English portable transmitter and receiver for this purpose is credited to H. W. Adey, a London radio expert. The combined equipment is no larger than a small lantern and weighs less than five pounds. A hook is provided on which to sling the apparatus from the officer's belt. Comprising a two-tube transmitting and receiving set, the equipment is said to have an effective service radius of from ten to twenty miles. The loud-speaker unit is built into the officer's helmet and is connected with the receiver by a flexible wire, inconspicuously placed. The loud-speaker is a unique affair, in that audible reception of messages is conveyed by vibrations through the skull instead of through air as the immediate transmitting medium. The equipment is battery-operated from a 45-volt unit, which has been reduced to a size somewhat smaller than the open hand.

In England, also, W. L. P. Dean has perfected a pocket radio receiver weighing only 1 pound 8 ounces and measuring 6 by 4 by 1 inch, which is designed to fit easily into an ordinary uniform pocket. Successful tests were recently conducted with this equipment at Brighton, England, in the

presence of Mr. Charles Griffin, Chief Constable, Mr. Dean, the inventor, and P. C. Redgrave, of the Brighton force, who was formerly a radio operator at sea. Messages sent out in ordinary speech from a transmitting station at the eastern end of the Brighton front were clearly heard five miles away. The success which has attended these and other tests of portable radio equipment presage the introduction of this new form of radio reception on a wider scale. Thus equipped, the foot patrolman is able to flash important crime information from his beat to headquarters and to cruising patrol units, who in turn may broadcast the information to other members of the force. Descriptions of wanted men, together with the details of the crime they have committed, could be circulated to policemen over a wide area within a few seconds after the crime is discovered.

The possibilities of this new development may be better appreciated when it is realized that, up to the present time, all radio patrol equipment has been mounted in automobiles in such manner as to become essentially a part of the car itself, much the same as the speedometer, starter, and other accessories. It is therefore necessary that one or more officers remain in the immediate vicinity of the machine at all times. In Los Angeles and other cities, where two officers are assigned to each patrol car, definite instructions are issued to the crew requiring the presence of at least one officer within earshot of the car's radio equipment during the entire tour of duty. In communities where the radio patrol car is manned by one officer, the patrolman must frequently be beyond range of the loud-speaker when leaving the car for response to calls. With portable equipment, officers may dismount at will for temporary patrol on foot, or to make assistance calls, yet remain in constant communication with headquarters. The individual policeman carries his communication system with him wherever he goes.

Additional communication facilities in the patrol car, besides two-way radio contact, are an inevitable future development, since this unit is destined to assume to an increasingly

greater degree the aspects and purposes of a mobile police station. A wide field is open for the installation and use of devices which automatically provide a written and visible record of the received message or communication in the patrol car. The cathautograph, a radio pen that broadcasts a written message, has already been developed. The sending apparatus is much like a slate upon which one writes with a pencil-shaped stylus. The written message is instantly received on a small phosphorescent screen which can be installed on a desk, in an automobile, or in an airplane.

The radio-controlled typewriter is now a practical instrument of communication. This device operates much the same as the teletypewriter, with the exception that land wires are eliminated and the ether becomes the transmitting medium. With the radio typewriter, it would be possible to broadcast the license number and description of a stolen car, for example, with the assurance that it would be received simultaneously in typewritten form by any number of patrol cars. Selective devices may also be provided so that messages may be received by one or more cars to the exclusion of all others. This instrument will undoubtedly be so simplified and reduced in cost that its use in patrol operations will follow as a matter of course.

Telephoto and television are both awaiting opportunity for more extensive use in police service. Ships at sea now receive the daily newspapers in facsimile by these methods. Weather charts of the North Atlantic are broadcast to navigating officers at frequent intervals. Recently an entire copy of a tabloid newspaper was flashed across the Atlantic by means of facsimile apparatus. This type of equipment has been installed in army planes for the purpose of sending maps and other pictorial information without the necessity of the plane's returning to its base. The possibilities of these new developments in communication stagger the imagination. Nevertheless, modern communities may look forward to the early application of many of them in advanced patrol operations.

Chapter VI

THE REGIONAL POLICE COMMUNICATION SYSTEM

THE RECENT GROWTH of regional police coördination in the United States rests upon two sets of conditions, involving (1) communication policy and (2) the complex police problems associated with the detection and suppression of modern crime.

The limited number of radio frequency channels available for police use has made necessary an extension of the operating scope and service of individual transmitting stations. A Bulletin of the Federal Communications Commission, relating to this matter, states in part:

The specific frequencies available for use by police radio stations are set out in the Commission's Rules and Regulations. As there are only eight frequencies available, the Commission is confronted with the necessity of providing for their greatest possible use.

After considerable study, it was decided that the entire country should be divided into zones, and that all cities within a zone should share the use of the same frequency. In this way it is possible to duplicate frequencies in different zones, and at the same time provide for an efficient system of operation within each zone.

There is a belief on the part of some police administrations that a separate frequency should be assigned to each municipality. With only eight frequencies available, such a system could not possibly be as efficient as the zone system of allocation.

For example, in one metropolitan area, there are nineteen cities located in eighty districts, nearly all of which are within twenty miles of the center of the district. Therefore, if different frequencies were assigned to each municipality, the adjacent police departments would lose the advantage of being notified of crimes committed in neighboring cities, with a consequent delay in the apprehension of criminals who succeeded in making their escape from one city to another.

Cities in areas such as that referred to above are encouraged to organize the metropolitan district type of radio service.

It is known that some applicants desire a metropolitan area system of communication, but cannot obtain agreements from all the cities

within their area. The Commission regrets that it cannot offer any immediate solution to such problems.

The Commission's plan must provide for the granting of radio facilities to every police department, regardless of whether or not it may desire radio service at the present time. This latter aspect of the Commission's plan is often overlooked by applicants when applying for facilities. The fact that no other city in the vicinity of the applicant's city desires immediate radio service cannot be accepted as proof that a neighboring city will not subsequently apply for radio service. Therefore, exceptions to the rules cannot be authorized.

In the interest of reduction of interference, an allocation of power based on population was selected in preference to an allocation based on the area to be served. Municipalities having large populations need more power than those of less populous areas because of the greater attenuation of the radiated energy due to building construction. It has been determined after careful study that most of the small municipalities which occupy greater geographical dimensions than some of the larger cities are not handicapped with the transmission difficulties usually present in the more populous districts.

The amount of power that may be licensed is specified in Rule 329. Where two or more cities desire to coöperate, the power is computed on the basis of the population of the entire area to be served.

Power limitation is a function of the limited number of frequency channels which may be allotted for police use. The maximum amount of power that can be assigned to the respective police stations is based upon the latest Census figures for cities or state subdivisions.[1] This power limitation is of course specifically designed to lessen interference on the available police frequency channels and permit a maximum geographical distribution of licensed police transmitting stations. But this limitation resulted in the installation of transmitters of insufficient power to cover effectively the area to be served. In the average city of 85,000 to 100,000 population, it would be a rare engineering feat, indeed, to obtain adequate coverage with the 50-watt transmitter to which such a city is restricted. This condition, an outgrowth of frequency limitations, has led to the consolidation of service areas into regional systems of police radio communication.

[1] Power allocation tables may be obtained by addressing the Federal Communications Commission, Washington, D. C.

At least three outstanding surveys have been conducted recently in the United States, in an effort to present the advantages of regional coördination of police man power and equipment. Under the supervision of August Vollmer, former President of the International Association of Chiefs of Police, David G. Monroe,[2] of the University of Chicago, made a study of the Chicago metropolitan area, analyzing the factors which indicated the desirability of a consolidation of the police facilities in that area. Bruce Smith,[3] an able critic of police administration, recently prepared a regional police plan for Cincinnati and its environs, undertaken in the belief that police service in southwestern Ohio and northeastern Kentucky could be substantially improved by a program of joint action affecting all police units in the area surrounding Cincinnati. A third survey[4] was completed in 1933 under the direction of the Sheriff's Office in Los Angeles County, as a basis for the formulation of a plan whereby the Los Angeles police transmitter might be used by all police units in the entire county.

Mr. Smith showed that the very limited territorial jurisdiction of police forces in the Cincinnati region often prevented effective police action, and that a sharp break with the past must some day be made if major improvements in service were to be realized. He pointed out that police protection that is now being provided by rural communities was established at a time when the most commonplace of modern facilities were not available. The area included in the Cincinnati survey involved 6 counties, comprising 51 townships and 13 magisterial districts, with 12 cities and 65 villages superimposed upon them. Each of these governmental units maintains some sort of police establishment, so that in the whole region there are 147 police agencies, each independent of the others, and all of them overlapping more or less. They are distributed

[2] David G. Monroe, *Chicago Regional Survey.*

[3] Bruce Smith, *A Regional Police Plan for Cincinnati and Its Environs.*

[4] The Sheriff's Office, Los Angeles County, California, *Los Angeles County Survey.*

over 2045 square miles of compact territory, with a total population of almost 1,000,000 inhabitants.

The Chicago metropolitan region is not composed of many huge and self-sufficient police forces, but is a great mass of 698 relatively small units, independently operated, which singly are too often unable to provide the protection necessary in this modern era of crime. The need for scientific coördination of police activity in such a situation becomes vitally apparent. Municipal forces are of course responsible for the protection of the public welfare within the villages. State police have assumed this function on the highways, and the sheriff's deputies attempt to offer protection over an entire county that is outside of municipal limits. Park police and forest-preserve police have their individual functions. Thus police protection becomes characterized by the individuality of many small forces, each force attempting in its own way to meet its individual problems, and the region as a whole is without any general or comprehensive means of combating the crime within its borders.

Within the boundaries of Los Angeles County lie forty-three incorporated cities and many areas in unincorporated territory which, because of density of population, present the aspect of cities, so far as police protection is concerned. Several of these cities and areas are contiguous and none of them is separated by more than six or seven miles from some other. It follows that a crime may be committed in one city and, since a speed of fifty miles an hour no longer attracts attention on the highways, the criminal escaping in an automobile is in another city in ten minutes or less. Within an hour the offender may pass through several cities in the area.

The Cincinnati survey showed that, although the 147 police agencies in that area were independent of one another in a political sense, they could readily be made interdependent in matters of routine and emergency police work. Thus, the city of Cincinnati, with its more extensive police facilities, can profit substantially from any plan which will make police information and general information concerning crime through-

out the area quickly available to its own police force. It can profit also from any means of rapid communication which may be set up whereby reports of offenses can be relayed to the most remote parts of the region.

Of special significance would be the control of strategic points of egress from the area by making possible the direct observation of the various radial highways and railways in emergencies. The tangled skein of highways and railroads which begins in Cincinnati and spreads out into the surrounding area is typical of the facilities that are at the disposal of the criminal in every section of the United States. In the Cincinnati region, all the main highways can be placed promptly under observation at twenty-three control points. Each represents a place where some form of twenty-four-hour police service is available. The provision of direct communication lines to these twenty-three points would make possible the surveillance of all public and private highway traffic flowing over main arteries. Main railroad lines serving the region could also be placed under observation in emergencies. For the most part, such control points are the same as those provided on highways, a total of twenty-eight being required to cover, in this Cincinnati region, the improved highways, railroads, and ferries taken together.

The smaller communities may profit through coördination of their protective and investigating work with that of the metropolitan department. The latter can provide services in training, in criminal identification, in the operation of modus operandi systems, and can function as a communication center. All these are services which are now completely lacking in nearly all the other police agencies and which the smaller police forces, whether acting alone or collectively, could never hope to provide for themselves.

THE REGIONAL COMMUNICATION PLAN

Regional coördination is in large part a function of communication facilities. At present, commercial telephone and telegraph lines represent the only quick method of commu-

nication between separate and independent police units. Such facilities, however, merely tie together the headquarters offices and do not immediately reach the patrolman on his beat. Long-distance telephone communication is a luxury for most of the small forces and the expense involved has handicapped its use. The Chicago survey revealed a typical situation.

The Cook County highway sheriff's office force is the largest of all the sheriffs' police staffs and has been established primarily as a coördinating agency to assist citizens in their problems. The highway force is centered in three headquarters in the region, one at Morton Grove, one at Homewood, and another at Willow Springs. All three stations are within a radius of approximately fifteen miles from headquarters in Chicago. There is no way by which the three may keep in touch with one another, or with headquarters in Chicago, except by telephone. No private line exists, and so the ordinary pay-station telephone is used by the stations. A call from the Morton Grove station to Chicago costs fifteen cents, and a call from Homewood, twenty cents. The officer calling must pay telephone charges in advance. Owing to the rather peculiar financial status of the county, some of the men have not been reimbursed for several years for charges which they have paid.

It was also found that among municipal chiefs as well, there was a dearth of long-distance telephoning. Village councils invariably frown upon large long-distance telephone bills. A village chief who incurred a toll bill of $1.20 was informed by council members that, unless he could be more careful with village funds, he would have to seek a new position. The data collected from village police chiefs brought out the fact that, in more than fifty departments, councils were constantly making some complaint concerning police expenses. Naturally, coördination between municipal police chiefs remains more or less a local matter; communication between far separated points rarely takes place except by letter.

Even where coördination by telephone between closely adjacent points is attempted, the unavoidable delay is fatal to

good police work. The police official in a given community must telephone to other police departments when broadcasting an alarm. After this time-consuming process has been completed, many minutes and perhaps hours may pass before the effective strength of the several police forces in the area is acquainted with the information. Meanwhile, a criminal has the choice of half a dozen or more excellent roads of escape, and this generally means that a police chief must call a dozen or more departments in the surrounding area in order to guard strategic highway control points. The perpetration of one bank robbery necessitated forty minutes of telephoning to inform the police officials within five miles of the crime. By the time half a dozen police departments were on the lookout, the robbers' car and its occupants were safely under cover twenty-five miles away.

The Cincinnati survey directed attention to the speed and efficiency of the teletypewriter in police communication, and recommended the extension of the Cincinnati police teletypewriter service to the twenty-eight communities in that area.[5] A typist seated in the police station at Cincinnati types the details of a gas-station robbery, the message being automatically recorded in printed form by receiving machines in all the stations in the region. Thus, accuracy of information is combined with the speed of the electric current, and an alarm may be spread over a wide territory within a few seconds.

A few years before the Chicago survey was made, a step toward mechanical coördination was taken when a teletype hook-up was established between Chicago and three neighboring cities, namely, Oak Park, Evanston, and Winnetka. Plans are now being considered to link the entire region in a teletype network, through which seventy-two police forces in the area will be connected with the Chicago police department, and a switchboard in Chicago will make possible coördination between sheriff and municipal police. The ideal plan contemplates the coalescing of the entire region in Indiana, Illinois, and Wisconsin, through the designation of the county seats as

[5] See Chapter VII, "The Police Teletype Network" (p. 242).

the centers of the respective county police stations, each center being connected to Chicago by a direct trunk line. If a gas station has been held up in a small town in DuPage County, for example, that town will at once telephone the information to county headquarters, which in turn will teletype the information to Chicago. From that point, of course, the alarm with pertinent description and information will be spread without loss of time throughout the entire area. If a bank robbery has been committed in Kane County, within a few seconds DuPage County officials can know of it and block every road leading from Kane County into Chicago. Thus will Chicago become the switchboard for the entire region.

The teletypewriter is a remarkable medium for meeting the requirements of fast communication between police stations in the regional system. However, the station is merely a point of transfer for the crime report. It is when the individual patrolman has received the information and has taken up his post at a highway control point or other strategic place, that the regional machinery really begins to function in the emergency. Both the telephone and the teletypewriter are limited to communication between fixed stations. The radio, by eliminating the necessity for land wires as the transmitting medium, has provided the ideal link between the station and the mobile patrol force.

THE REGIONAL RADIO COMMUNICATION SYSTEM

One of the most important developments in the field of police radio has been the extension of the service area of the municipal police radio system to include adjacent jurisdictions. Under such an arrangement, a single police transmitter may be made to serve a dozen or more police departments within the area concerned. For example, the transmitting station of the Police Department at Berkeley, Calif., dispatches all broadcast traffic for police agencies in the counties of Alameda and Contra Costa, including all city police departments and sheriffs' offices. With proper telephone and teletype facilities to expedite the receipt of calls from outside depart-

ments, and a competent dispatching organization, effective and adequate communication is available for all mobile units in the two counties.

The cost of radio transmitting equipment is another factor in the consolidation of radio operation. A modern police radio transmitter is a comparatively expensive instrument. Many police departments, particularly in the smaller communities, could ill afford such an expenditure. The installation of a central transmitter for the combined area is actually a step toward economy; for it is only necessary that outside departments equip their cars with the necessary receiving apparatus, and this is a comparatively inexpensive affair. As a rule, the central station makes no charge to the smaller community for the broadcast service, because of the benefits that accrue to the larger department in the increased police efficiency throughout the area.

Experiments conducted by the Cincinnati Police Department indicated that police broadcasts sent out from that city could easily be received at all points within the police region. It was in August, 1930, that radio became possible as a new method of regional intercommunication in the Chicago area. Originally planned only as a means for directing the movements of the force within the city, the almost immediate action of neighboring towns has now made the radio station a regional coördinator. Within the short span of a year and a half, forty-one towns have radio-equipped cars cruising in the region.

With its three transmitters, the Chicago Police Department now flashes signals to forces throughout the area. WPDC broadcasts to nineteen police departments to the west; to the south and southwest, WPDB, the south-side station, sends out its messages to police forces in ten communities; on the north side, WPDD keeps twelve communities in touch with events. From Lake Forest to the north and Harvey to the south near the Indiana border, and Villa Park far to the west, there is maintained a swift coördination of police strength in this area by day and by night.

By June, 1930, only seven months after the installation, the number of regional broadcasts had jumped to 1345 for that month. Of this total, Evanston received 470, Oak Park 212, Maywood 175, and River Forest 77. At the beginning of 1931, sixty-six radio-equipped cars were operating in the region, exclusive of the city of Chicago.[6]

The organization of a police regional radio system has certain legal aspects. Prior to an assignment of additional transmitting power on the basis of the increased population served, the Federal Communications Commission requires that all municipalities and jurisdictions represented in the total population figure subscribe to written agreements or contracts covering the projected regional communication service. An essential part of the agreement is that all contracting parties, with the exception of the one obligated to supply broadcast service to the area, indicate their willingness to forego any future application to the Commission for the right to operate a transmitter. Thus, in return for the usual grant of increased power to the region, the Commission's problem of police frequency and power distribution is appreciably simplified through a reduction in the number of potential applicants for station licenses. Such agreements or contracts are further desirable with respect to the individual police forces concerned in the regional merger, since they are a record of the transaction and afford a stable and businesslike basis for the future operation of the system.[7]

[6] Toward the close of 1937, approximately eighty-five such regional radio systems were in active operation in the United States. Among the stations serving a plurality of police forces were those of Atlanta, Ga.; Beaumont, Tex.; Berkeley, Calif.; Buffalo, N. Y.; Chicago, Ill.; Cincinnati, Ohio; Cleveland, Ohio; Dallas, Tex.; Dayton, Ohio; Denver, Colo.; Detroit, Mich.; Flint, Mich.; Fresno, Calif.; Honolulu, T. H.; Houston, Tex.; Indianapolis, Ind.; Kansas City, Mo.; Kokomo, Ind.; Lexington, Ky.; Louisville, Ky.; Milwaukee, Wis.; Minneapolis, Minn.; Oklahoma City, Okla.; Omaha, Neb.; Portland, Ore.; Richmond, Ind.; Rochester, N. Y.; St. Louis, Mo.; St. Paul, Minn.; Salt Lake City, Utah; San Francisco, Calif.; Sioux City, Iowa; Syracuse, N. Y.; Washington, D. C.; and Wichita, Kan.

[7] For specimen contracts, see Appendix 2, p. 489.

THE REGIONAL SYSTEM AND THE RURAL POLICE PROBLEM

One of the most immediate advantages of the regional communication system has been increased effectiveness of the police power in rural areas, because most of the regional systems extend a broadcast service to members of the sheriff's force and to other agencies that are charged with the policing of those areas. This is extremely fortunate, since the large, sparsely settled sections lying outside the jurisdiction of municipal police forces have for the most part been left exposed to the incursions of criminals and other infractions of law and order. The scheme of police organization now obtaining in rural areas is often quite inadequate to meet modern requirements; but rural political subdivisions may minimize the effects of this condition by establishing rural patrols and bodies of criminal investigators, coördinated in action by means of the regional organization of communication facilities. If this work is well and thoroughly performed, the absurd patchwork of county, township, village, and city police forces will become less ineffective during the years that must yet pass before the whole medieval pattern is swept away and a more rational system substituted.[8]

The signs which point to this as an eventual development become increasingly clear. In Iowa and in Illinois a statewide system of rural vigilantes has been organized, signalizing, according to one commentator, the collapse of the sheriff-constable régime as a device for police protection. In many other states a movement is rapidly gaining headway to merge the smaller counties and towns so that a basis may be laid for governmental action along a wider front. State police forces are an accomplished fact. Everywhere is found a growing recognition of the need for larger governmental units in order that more adequate police services may be organized.

In 1932, the author made a questionnaire survey covering seventy-three counties and one state, and representing, in all, thirty-two states, for the purpose of ascertaining how far

[8] Bruce Smith, *op. cit.*

communication facilities are employed in rural police service. In most of the states reporting, police protection in the rural areas outside the limits of incorporated cities and towns is given chiefly by the sheriff and his deputies. Some towns and townships have their own constables and a few states have state police organizations which police the rural areas, and the sheriffs coöperate as much as possible with these law-enforcement agencies.

The organizations through which the sheriffs meet their responsibility for the maintenance of law and order and the apprehension of criminals fall roughly into three classes. In thirteen of the counties reporting, the sheriff and all his deputies gather at one central station, from which they respond to all calls. In twelve counties, part of the sheriff's force is stationed in a central office, and the rest of the force is decentralized and scattered throughout the county. In some large counties, including Los Angeles and San Bernardino counties, Calif., regular substations are maintained. In others, the paid full-time deputies are centralized in one station, and special deputies who may be paid for the time in which they actually perform police duties, or may not be paid at all, are scattered throughout the area. These special deputies look after small matters that require attention and take charge of more important matters until the sheriff or his regular deputy arrives.

As the rural law-enforcement agency, the sheriff does not, as a rule, depend entirely upon the resources of his own office. If constables are available in his county, and they usually are, the sheriff attempts to keep in close touch with them. In a few counties the constables are deputized and in one, Los Angeles, the constabulary is a regular part of the sheriff's office. The sheriffs also, as has been mentioned, make an effort to work in coöperation with the police departments of the cities and towns in their county, and keep in close touch with local state police organizations,—if there are any,—even using their communication facilities, as is done in New York. Even if the state police are only highway patrolmen, the sheriff usually

coöperates with them; a few sheriffs reported that the highway police were deputized and took general charge in emergencies until a regular deputy arrived.

In two states, Nebraska and South Dakota, there are state sheriffs who aid the local sheriff in meeting unusual problems. Finally, in some states, especially in the Middle West, vigilante committees have been organized, usually as a protection against bank bandits. These committees work in close coöperation with the sheriff and take orders from him. In some places the vigilance-committee members are deputized.

The survey showed that the telephone is almost the sole instrument of rural communication. Through the telephone the sheriff receives calls for help, communicates with his deputies at home or at stations isolated from the central office, and receives calls and reports from deputies who are out on calls or on patrol. The telephone and the automobile are the two typical communication and transportation facilities of the rural police. The ordinary sequence of law enforcement in the county is the reception of a call coming into the sheriff's office over the telephone, and a response by the sheriff or his deputy in an automobile.

A few sheriffs have made special arrangements with the telephone company for a more rapid handling of emergency police traffic. It is surprising that more sheriffs have not done so. The sheriff of Montgomery County, Ohio, in which Dayton is situated, has divided it into four zones. Through a prearranged plan, the telephone operators, on being given the number of any of the four zones, promptly call all the deputies in that zone and connect them with the sheriff's office. In three counties in Iowa, the sheriffs have arranged with the telephone company that, when need arises, the telephone operator shall mobilize the various vigilance committees in towns throughout the area, and put them in touch with the sheriff's office. In another county in Iowa, calls to and from the sheriff's office are given priority.

The telephone is also the sole means employed by members of the sheriff's office to keep in touch with the central station

when they are away on their duties. In some counties the sheriff requires his men to report regularly to the office when out on duty, using whatever public or private telephone is most conveniently available. Ordinarily, these are the public telephones in gasoline stations, restaurants, garages, and other similar places. In only one of the counties reporting, Fayette, Ohio, has a system of call boxes been installed for the use of these cruising deputies; this installation is a recent result of the Cincinnati regional police communication plan previously discussed.

The teletypewriter is little used, apparently, by the sheriffs of the United States. Only one sheriff—of Los Angeles, Calif.—reports the use of a teletype system for intracounty communication, direct teletype lines connecting his main office in Los Angeles with the nine substations in the county. Only two states, Oregon and California, report connections between the sheriff's headquarters and the state teletypewriter systems. The sheriff of Lane County, Ore., stated that he was being connected with the Oregon state system, then in process of installation, and the sheriffs of twenty-one counties in California reporting gave the information that they were either already connected with the state teletypewriter system, or had access to its facilities through some other office, or were planning to be connected. Only one of the six sheriffs from New York, Pennsylvania, New Jersey, and Connecticut who answered the questionnaire mentioned the use of the teletypewriter systems with interstate connections. In the United States generally, the teletypewriter has not begun to reach its stride in the rural police communication scheme.

Radio communication, the survey indicated, is rapidly becoming of major importance in rural police protection. Most of the seventy-five or more regional radio systems now in operation provide for radio broadcast to the cars of sheriffs or county police. Several sheriffs reported the independent operation of their own transmitters, and others indicated an intention of installing their own equipment. Some of these radio-equipped cars are connected with a state radio system;

for example, those controlled by the sheriffs in Michigan, which has adopted a state police radio system by law. The Buckeye Sheriffs' Association of Ohio plans to install a state radio system similar to the Michigan network, and two Ohio sheriffs, of Montgomery and Clark counties, respectively, indicated keen interest in this development. The sheriff of Lane County, Ore., also stated that his state contemplated the installation of a state radio system, in addition to the teletype system then being installed.

Probably the most thoroughgoing study of the rural police-communication problem that has ever been made, was completed in 1933 by the Sheriff's Office of Los Angeles. The results of this survey confirm present indications and definitely point the way toward a growing use of radio-equipped patrol cars in rural areas. This survey further emphasizes the fact that, in the future development of regional police communication systems, full recognition must be given to the needs of the rural section.

The size of the police problem facing the sheriff of Los Angeles County and the consequent need of an efficient system of communication, can be more easily understood if the topography of his territory is considered. Los Angeles County covers an area of 4115 square miles. Nearly one-half of the northern part is extremely mountainous, dry, and barren, and has few communities that are connected by good roads. On the west, the county is bounded by eighty miles of seacoast, along which are scattered ten beach cities of varying population, one of 50,000 and another of 150,000. In the southwestern part is the harbor district. To the east near the foothills are large residential sections through which run several main arterial highways leading eastward into the neighboring state of Arizona. The total population of the county in 1930 was 2,208,000, more than half of which is in the metropolitan area of the city of Los Angeles. Within the county are scattered forty-four incorporated cities with populations ranging from 2300 to more than 1,200,000. Of these forty-four cities, more than thirty are within a radius of approxi-

mately twenty miles of the center of the city of Los Angeles.

The population is mixed, the principal foreign nationals being Mexicans, Russians, Italians, and Japanese. The people engage in a variety of occupations, chief among which are farming and gardening, manufacturing, shipping, and oil production. The rapid growth of the county in recent years and its development in all lines of profitable activity, the constantly increasing population both American and foreign, and the favorable climatic and other conditions for continuous and easy movement back and forth within the county, have all presented crime possibilities and serious crime problems.

The Los Angeles County Sheriff's Office, at the time of the survey, had already been organized on a regional basis. A central division was placed in the city of Los Angeles, and nine substations were distributed in various sections of the county. These substations are the outposts of the sheriff's department and through them communication is had with the citizens of the area. Through them, also, the greater number of crime reports are obtained and many of them investigated. The duties of the personnel of the substations include the patrolling of the area assigned to the station and the investigation of almost all the misdemeanor cases occurring, and of felony cases directly assigned to them by the central office.

Since the general office, the chief administrative officers of the department, and the central record division are in Los Angeles, the principal communication problem of the sheriff's department was the devising of a system which would be a speedy and reliable communicating medium between the central station and the various subdivisions. For its communication requirements, the Sheriff's Office relies primarily upon the teletypewriter system. This network consists of twenty-two machines, two of which are placed in each of the nine substations, and a main battery of four in the division of records and identification of the central office. The substation machines, which are equipped for both sending and receiving messages, are connected with the bureau by direct private

telephone lines. Three of the main batteries in the record division are equipped for both sending and receiving messages from substations, and one, known as a broadcasting set, is connected with all stations through a specially arranged and constructed control board, making it possible to broadcast to any one or to all stations at the same time.

That the teletype system has many marked advantages over other usual communication methods is amply demonstrated by the equipment in the Sheriff's Office. It is particularly adapted to the needs of substations in obtaining accurately such information as criminal records, automobile license numbers, house numbers, and other concrete information from the central office, for the use of investigators.

All reports required between the substations and the central office are speedily and accurately sent over the teletype machines with less labor than was formerly required for typing the reports and mailing them. A general alarm may be broadcast to all stations over the system instantly; if sent by telephone as in the past, it would take two men at least thirty or forty minutes to transmit it. Further, the teletypewriter permits substations to communicate with one another through the control board in the main office. Moreover, information sent by this means, being in print, is more accurate than information transmitted by telephone; also a permanent record of each communication is made. The sheriff's teletype system is connected with the California state network, and all important messages received over the state-wide system are sent either to all substations or to those which might be particularly concerned.

The telephone is still indispensable in the receiving of complaints and reports from citizens concerning matters of interest to the sheriff, and for all communication by the department with outside persons. It is also a means of keeping in touch with the 152 constables who police the townships of the county.

Rural sections in comparison with metropolitan areas present a wide divergence in patrol conditions. In the cities are

to be found a more or less concentrated population, telephones that are readily accessible at all hours, relatively small patrol areas with consequent short distances to the scenes of crime, and paved and lighted streets with house numbers prominently and frequently placed. These conditions lead to quick arrival of help when need arises, and to short hauls in transportation of prisoners. They also permit the immediate return to patrol duty and the frequent appearance of a patrol car at any given point. The conditions prevailing in the territory which the sheriff is called upon to protect are very different. The patrol areas are large and irregular, densely populated in parts but with wide reaches of sparsely settled territory, infrequent house numbers mostly indiscernible from a car in the street, no roadside telephone system reserved for police use, comparatively few private telephones available (virtually none after midnight), dirt roads, and, in many places, little or no street lighting over wide areas.

With the advantage of the use of the Los Angeles police transmitter, the sheriff's survey was carried forward on the nights of Saturdays and holidays, since these periods showed the greatest criminal activity and so yielded the greatest number of calls per night worked. In the course of these studies, several of the sheriff's substations were used as headquarters at various times, but most of the work was done from Substation No. 2, in Belvedere, as that proved to be the most active district.

The answering of one hundred radio calls, together with the patrol duty involved, was arbitrarily decided upon as a sufficient test to yield reliable data upon which to base sound conclusions relative to the future possibilities of this type of radio organization and procedure in the solution of the rural police-communication problem. One hundred and six calls were responded to and recorded in the course of the study. Fair weather, fog, and rain were among weather conditions contended with.

Further studies relative to time elements and methods were carried on in the control room in the Los Angeles City Hall,

from which the Los Angeles Police Department radio calls are sent, and in the transmitting stations of both Los Angeles and Pasadena. In addition, time and interval studies were made in the night hours with private receiving sets.

The work in the field was done by two staff members of the Bureau of Efficiency, who carried credentials permitting them to ride in any sheriff's car at any time. They usually worked in company with the sheriff's deputy who had the direction of the radio patrol survey from its inception and authority to direct the handling of calls with respect to radio in all substations. Thus, though at the beginning of the survey there were available but three cars equipped with radio receivers, it was possible to take one or more of these machines with its crew to any substation and test out the need for, and possible results to be obtained by, the use of radio cars in that district, without in any way disturbing the routine operation of the substation. The scope of the study was thus made county-wide.

Usually the the work was started at 4:00 P.M., and continued until 6:00 A.M. the following morning. When the radio patrol car left the station at the beginning of a patrol period, the time was noted and the speedometer reading taken. When a call was received for that car, the call was given its proper serial number for identification, and the data were recorded under the following heads: (*a*) time of call; (*b*) elapsed time, from receipt of call to arrival at destination; (*c*) car location (at time of call); (*d*) call location (scene of crime); (*e*) nature of call (burglary, holdup, disturbance, or whatever); (*f*) disposition (arrest, warning, or whatever); (*g*) miles per run. At the end of the patrol the time was noted and the speedometer again read. All "elapsed time" intervals were determined by a stop watch to the nearest second, on each run made.

In this phase of police work, each case, if considered individually, is surrounded by a specific set of circumstances which have a definite bearing upon the time intervals involved. Thus, consider two radio calls requiring runs of equal distances. One may find the car returning to the station with

several prisoners who must be disposed of before the run can be made; to the other, the car may be free to respond at once. One call may involve an auto accident clearly visible to an approaching police car at a distance of several hundred feet; the other may require the locating of a residence in a district where the houses are set far back from an unlighted street or roadway, making a search on foot necessary in finding the proper address.

Clearly, the element of time elapsing between the receipt of a call in the car and the arrival at destination is a widely variable quantity, with respect to field conditions alone.

A total of fifteen nights or parts thereof was devoted to patrol, in which 126 hours were spent on the roads and 939 miles were traveled. This time includes all stops and delays of every sort and indicates that an average of 7.45 miles was traveled for each hour, or 59.60 miles per 8-hour watch. A total of 192.95 miles was traveled in responding to 106 calls. The average speed while on the run on call response was 23.02 miles per hour. The maximum length of run was 12.50 miles, requiring 23 minutes 12 seconds, and the minimum distance and time were each zero. These minima came about because the car, in the course of its regular patrol duty, arrived at the scene of the trouble coincidentally with the receipt of the call directing it to go there. This occurred twice in the course of the work.

The total mileage (939) and that part of it run in response to calls (192.95) indicate that 20.55 per cent of the mileage covered by a radio car would be spent on the run in response to calls. The rest is chargeable to patrol duty, prisoner transportation, transportation incident to accidents, trips to hospitals necessitated by transportation of accident victims, and other routine matters.

Analysis of the 106 runs with respect to length of time passing between receipt of call and arrival at destination showed that 12 calls required 1 minute or less; 11 required more than 1 minute but not more than 2 minutes; 20 required more than 2, not more than 3 minutes; 20 required more than 3, not more

than 4 minutes; 28 required between 4 and 8 minutes; 12 required between 8 and 15 minutes; and 3 took more than 15 minutes. Analysis of all runs with respect to cause showed 38 different types of report received. Calls originating under the head of "Disturbance" were 19, "Auto accidents" 9, "Fight" 8, "Burglary" 7, "Go to your station" 7, "Call your station" 5, "Fire" 4, "Investigation of a car" 4.

Data on the time passing between receipt of a complaint in a substation and the broadcast to a radio car were noted as opportunity offered, and were supplemented by substation records. The average was 1 minute 58 seconds; the maximum, 14 minutes 0 seconds; the minimum, 0 minutes 30 seconds.

Using the average time interval between the receipt of the call and the broadcast (1 minute 58 seconds) and the average interval between receipt of call and arrival at destination (4 minutes 45 seconds), it was found that the average time that a citizen may expect to wait between the registering of his complaint with a substation and the arrival of a radio car at his door was 6 minutes 45 seconds. This time would of course be longer in the larger, sparsely settled districts. The sum of the minima as given above indicated that a car may arrive at the scene of a crime 30 seconds after the complaint reaches a substation. The sum of the maxima indicates a remote possibility of 37 minutes 12 seconds. These figures are given as the extremes, since it is very unlikely that either all the maximum or all the minimum elements would concentrate in any one occurrence.

This part of the survey proved convincingly that through the use of radio-equipped patrol cars a metropolitan type of police service can be extended to rural sections. In sparsely settled rural districts where patrol areas must necessarily be large, an average operating-time interval of 6 minutes 45 seconds represented a drastic reduction in the customary delay between the time that a citizen registered a complaint and the arrival of officers in response.

Los Angeles County authorities next cast about for a police-operated transmitter capable of meeting their requirements.

Within the immediate area police transmitters were located at both Los Angeles and Pasadena. The city of Los Angeles operates a 400-watt De Forest transmitter, using energy from the city's Bureau of Power and Light. A gasoline-operated auxiliary-power unit is maintained at the station in order to ensure continuous operation in the event of a temporary failure of the regular power supply. The transmitter cost $7200 in very close competitive bidding, and the maintenance charges are about $200 a month. To operate this station two operators and one relief man are employed for each 8-hour shift. All are police officers receiving $200 a month and the monthly payroll is therefore $1800. In addition to this station payroll, various clerks and dispatchers are employed in the control room at the City Hall.

The Los Angeles Police Department at the time was broadcasting for twenty other cities, three of which were in Orange County and the rest in Los Angeles County. As previously noted, it also broadcast the sheriff's calls in the experimental period covered by this survey.

The Pasadena transmitter is in a penthouse on the roof of the Pasadena Hall of Justice. The equipment is an installation of 500 watts capacity, but is limited by license allowance to the use of only 100 watts. The broadcasting is done by remote control from the Desk Sergeant's office on a lower floor. The calls are not repeated by the station operator, as in the Los Angeles system, but are put on the air twice by the same man. The Pasadena station broadcasts also for the cities of South Pasadena, Arcadia, and Sierra Madre; it also had an agreement at the time to broadcast for the city of San Marino, but no radio cars had yet been placed in operation. The system used in Pasadena is fundamentally the same as that used in Los Angeles, but much less elaborate, as the entire radio-car fleet comprises only eleven patrol cars and one ambulance.

Several alternatives were presented as a solution of the transmitter problem. With forty-two incorporated communities in the county, assume each department to be equipped with a transmitter, but all on different frequencies or wave

lengths. The broadcast from the city in which the crime is committed is received in its own patrol cars and in no others. The result is a circumscribed area of effective service, for, once the criminal passes the limit of that city, he is free to make his identification difficult or impossible so far as radio pursuit or detection is concerned. Now assume that each city concerned operates a transmitter, but all on the same frequency. Here is introduced the interference and delay occasioned by the efforts of various units to get on the air at the same time. This, however, is not necessarily the most important drawback, though circumstances may readily be imagined under which delay might become serious.

True, through a signal arrangement between the different transmitting units, the air might be cleared for the broadcast of a major-crime alarm, but this requires time and is subject to both confusion and delay. The greatest drawback to success under such an arrangement, assuming that it were permitted by the Federal Communications Commission,—which is unlikely,—is that the factor of power would be so restricted as to limit the radius of audible broadcast. A criminal could within a short time pass out of the field covered by the transmitter of the city wherein the crime was committed. This is clearly illustrated by the Pasadena station, which is operating with only 100 watts power under a power restriction of the Commission. Pasadena calls are so faint that they are frequently inaudible in the Belvedere district, and elsewhere in the county at no great distance from the transmitter.

Obviously, independent broadcasting by political units in a limited area fails of its purpose. When one considers the problems faced in the transmission of crime alarms and other police matters over an area and under such conditions as are found in Los Angeles County, with its population of 2,200,000 and its numerous communities the interests of which in police protection are fundamentally the same, it is clearly seen that the establishment of an independent transmitter plant is not a proper solution. In respect of practicability, such a plant could only add complication to a situation wherein simplicity

and unity are synonymous with efficiency and success. In respect of economy, the answer is even more clear.

Both the city of Los Angeles and the city of Pasadena informally indicated through their radio departments a willingness to broadcast sheriff's calls should the county set up a radio-car service. The work could be done by Los Angeles with no addition to personnel nor alteration or rearrangement of equipment. In Pasadena some changes would be necessary. Los Angeles would do the work on the basis of a small charge for each call; Pasadena's suggestion was to prorate the total cost of transmitter maintenance.

The saturation point of the Los Angeles transmitter was an important consideration, since it was necessary to determine whether it would be able to accommodate the additional broadcast traffic from the sheriff's office. The number of sheriff's calls for January, 1933, was 383, an average of about 13 a day. For February, 1933, the total was 411, with a daily average of 15. When one is considering these figures, it must be borne in mind that the sheriff's experimental radio cars were working in the more active substation districts. With the entire county brought under radio-car patrol, it was estimated that the number of sheriff's calls under present crime conditions would not exceed 1200 a month.

On a basis of 1200 a calls a month, or even twice that number, the cost to the county if the broadcasting were done by either Los Angeles or Pasadena would be considerably less than the single item of transmitter-station payroll if an independent transmitter was installed. The question of whether or not the county should install its own transmitter was clearly answered in the negative.

The question arose, How much of the twenty-four hours of the day was actually consumed by police broadcasts? In other words, What percentage of the time is the air occupied? or, How nearly has the saturation point been approached over a reasonable period?

Studies indicated that the period of greatest activity was from about 8:00 P.M. to 1:00 A.M., and several tests were run

in order to determine as nearly as possible the maximum degree of saturation to be expected under present conditions. Finally the test run of the night of March 4, 1933, from 8:10 P.M. to 1:15 A.M. was selected as showing the maximum traffic. The data derived from this test were as follows: Date of test, March 4–5, 1933; duration of test, 5 hours 3 minutes, or 303 minutes; times on air—Los Angeles 114, Pasadena 19; elapsed time on air—Los Angeles, 168 minutes 48 seconds; Pasadena, 3 minutes 3 seconds; total elapsed time on air, 171 minutes 51 seconds; percentage of time air was occupied, or degree of saturation, 56.72.

The Los Angeles transmitter at that time was broadcasting an average of about 15,000 calls per month, this figure including some 400 sheriff's calls, the calls of twenty smaller cities, and the Orange County Fruit Patrol calls. The test described above indicated that this load plus the Pasadena load brought about, at maximum concentration, a saturation of but 56.72 per cent. Should the number of the sheriff's calls be increased to 1200 a month (adding 800 calls to the figures shown by the test), the degree of saturation would be increased to only 59.72 per cent. It was evident that a serious condition of crowding did not exist, nor would it exist with a normal increase in calls for a long period to come.

Possessing marked advantages over all other forms of rural policing employed up to the present time, the radio-equipped patrol car gives a speedy and efficient protection to the residents of rural sections. Formerly, under the Los Angeles County patrol system, two kinds of service were offered to the public by the sheriff's substations: that of the "call car," and that of the "patrol car" or "prowler." The call car with its crew remains at the station until a call or complaint is received, whereupon it makes the run and takes care of the emergency. Once away from the station, however, all contact with the unit is lost until, its work completed, it returns to the station, possibly to be dispatched at once to another point only a short distance from the location of the first call, or, it may be, to stand by at the station for hours until its next call

comes. This stand-by service is of course necessary; yet it should be noted that during the stand-by hours—which are many—nothing is being done in the way of active protection for the public.

The prowler, on the contrary, being constantly on patrol, is thus always actively engaged in protecting the public. It is not, however, constantly in touch with its station, but it reports in by telephone occasionally, or returns to the station with prisoners, in the course of its regular duty. The value of the prowler lies entirely in the control of such crime or other trouble as may be detected by the eyes and ears of the crew. It is entirely possible that there may be desperate need for this car a short block from its location, yet the crew, though fully alert, may be in complete ignorance of the fact.

Neither the call car, nor the prowler, nor both together, though fully performing their several functions, constitute a very efficient weapon against crime. In order to secure performance of the two functions of prompt response to calls and at the same time patrol of the area, a minimum of two cars and two crews to man them was required by each substation.

Contrasting rather sharply with this type of service is that given by the radio car. Practically speaking, it is a patrol car, since it performs all the functions of a patrol unit or prowler; but it also performs all the functions of a call car, since it can be dispatched at any time, and from any point on its patrol, in response to an emergency. One radio car with its crew therefore does the work of two cars and two crews under the old system.

On the assumption that radio patrol would be made a part of the Los Angeles sheriff's service, a plan was proposed for the preliminary setup of patrol areas and the assignment of cars and personnel. It was recognized that the appearance of radio patrol in a district would probably cause rather decided changes in the crime situation, particularly in respect to its amount and distribution. Some of these changes might be sufficiently pronounced to warrant a readjustment in equip-

ment distribution, hours of patrol, boundaries of patrol areas, and other distributional factors. The ninety-eight men needed for radio patrol were to be drawn from the already employed forces of the nine substations, outposts, and constabulary when the new plan should go into effect; hence no increase in the salary budget was involved.

It was estimated that for the ten districts there would be required 21 radio-equipped cars for active service, two stand-by or relief cars, and one car for the officer in command of the radio patrol—a total of 24 cars, each equipped with a receiving set. The sheriff's department already had 57 cars, so the automotive requirements were well taken care of in advance. Three additional receivers were to be provided as stand-by sets for emergency replacement service, and a receiver at each substation to permit of checking broadcasts with respect to time and accuracy. Such equipment would also make it possible to keep the substations constantly informed of all the crime broadcasts that went out through the Los Angeles transmitter.

The Los Angeles County Sheriff's Office has set the pace in harnessing modern communication to the requirements of rural police protection. In more than 100 scattered sections of the United States where metropolitan police areas are now served by radio broadcast, the surrounding rural sections should be receiving the benefit of like service. It is significant that all counties employing radio-equipped cars have a large city within their borders; for example, in Monroe County, N. Y., is Rochester; in Cook County, Ill., is Chicago; in Marion County, Ind., is Indianapolis; in Wayne County, Mich., is Detroit; in Hamilton County, Ohio, is Cincinnati; in Franklin County, Ohio, is Columbus; in Doubles County, Neb., is Omaha; and Campbell County, Ky., although it embraces no large city, is a part of the Cincinnati regional development.

STATE-WIDE SYSTEMS

In its regional application, the service is not limited merely to a control of the patrol forces of surrounding municipalities and rural districts. There are now in operation state-wide regional police radio systems, which provide broadcast service to state police organizations and other police agencies throughout a wide area. Such extended regional communication plans usually depend upon the prior existence of an organized state police force, since the mosaic of political divisions and subdivisions over such a large territory would otherwise make the organization of police activities on a scale so comprehensive, quite difficult under present conditions. Most states, however, maintain a state highway patrol, and this unit is serving admirably as the basis for projected state-wide radio systems. The situation is, of course, ideal in those territories where a regular state police organization is maintained.

Until June 1, 1937, licenses for the operation of state police transmitting stations had been issued by the Federal Communications Commission as shown in the list on pages 232–235.

The most direct use of radio communication as a state-wide regional coördinator of police activities is to be found in Michigan, where, in 1929, an act was passed by the state legislature providing for a state-owned and -operated radio broadcasting station for police purposes only. Since the date of its installation, the Michigan state police radio system has made an enviable record and continues to operate as one of the most formidable weapons in the hands of the police for the detection and suppression of crime in that state.

In the other states mentioned, the application of state-owned stations to a state-wide system of police radio communication has not been quite so evident. The Commonwealth of Pennsylvania, through the Pennsylvania State Police, operates a broadcasting station for state business only. Station WBAK is on the broadcast band and functions as a broadcast station. Pennsylvania does not operate any radio patrol cars. Owing to the size of the state (45,000 square miles), it has been found

STATIONS OPERATING IN THE EMERGENCY SERVICE

STATE POLICE STATIONS

Call letters	Licensee	Transmitter location	Frequency (kc.)	Power (watts)
KADJ	*State of California, Dept. of Motor Vehicles	Sacramento, Calif.	1682	1000
KAPA	Same	Portable-mobile	1682	25
KAPI	Same	Grass Valley, Calif.	1682	50
WDSP	State of Delaware, Highway Dept.	Station No. 2 Highway Police, County of New Castle, Del.	1698	250
WAKJ	State of Florida	Duval County. Fla.	1698	350
WAKQ	Same	Tallahassee, Fla.	1698	350
WAKR	Same	Pensacola, Fla.	1698	350
WAKS	Same	Orlando, Fla.	1698	350
WAKT	Same	Tampa, Fla.	1698	350
WAKU	Same	Fort Myers, Fla.	1698	350
WAKZ	Same	West Palm Beach, Fla.	1698	350
WQPC	State of Illinois, Dept. of Public Works and Buildings	Chicago, Ill.	1610	1000
WQPD	Same	Duquoin, Ill.	1610	1000
WQPF	Same	Effingham, Ill.	1610	1000
WQPG	Same	Sterling, Ill.	1610	1000
WQPM	Same	Macomb, Ill.	1610	1000
WQPP	Same	Pontiac, Ill.	1610	1000
WQPS	Same	Springfield, Ill.	1610	1000
WQFE	State of Indiana	Seymour, Ind.	1634	1000
WQPW	Same	Columbia City, Ind.	1634	1000
WPHE	Same	Indianapolis, Ind.	1634	1000
WPHS	Same	Culver, Ind.	1634	1000
WPHU	Same	Jasper, Ind.	1634	1000
KACC	State of Iowa	Fairfield, Ia.	1682	500
KACD	Same	Atlantic, Ia.	1682	500
KGHO	Same	Des Moines, Ia.	1682	1000
KNFN	Same	Waterloo, Ia.	1682	400
KNFO	Same	Storm Lake, Ia.	1682	400
WAKY	Maryland State Police	Portable-mobile	1698	250
WEVN	Same	Belair, Md.	1698	250
WHWN	Same	Laurel, Md.	1698	250
WMSC	*Same	Cumberland, Md.	1698	250
WMSE	*Same	Easton, Md.	1698	250
WMSF	*Same	Frederick, Md.	1698	250
WMSH	*Same	Conowingo, Md.	1698	250
WMSW	Same	Waldorf, Md.	1698	250
WWSG	Same	Salisbury, Md.	1698	250
WMP	Commonwealth of Massachusetts, Dept. of Public Safety	Framingham, Mass.	1666	1000

* Construction permit issued.

STATIONS OPERATING IN THE EMERGENCY SERVICE

STATE POLICE STATIONS—*Continued*

Call letters	Licensee	Transmitter location	Frequency (kc.)	Power (watts)
WPEL	Commonwealth of Massachusetts, Dept. of Public Safety	W. Bridgewater, Mass.	1666	1000
WPEV	Same	Portable	1666	50
WPEW	Same	Northampton, Mass.	1666	1000
WRDH	State of Michigan	Houghton Heights, Mich.	1642	1000 N 5000 D
WRDP	Same	Paw Paw, Mich.	1642	1000
WRDS	Same	East Lansing, Mich.	1642	1000 N 5000 D
KNHD	Bureau of Criminal Apprehension, State of Minnesota	Redwood Falls, Minn.	1658	400
KIUK	State of Missouri, Highway	Jefferson City, Mo.	1674	1000 N 2500 D
KRNP	State of Nevada	Reno, Nev.	1634	1000
WPGC	State of New York	So. Schenectady, N. Y.	1658	1000 N 5000 D
WNAH	*State of North Carolina	Raleigh, N. C.	1706	1000
WANI	*Same	Williamston, N. C.	1706	1000
WANJ	*Same	Swannanoa, N. C.	1706	1000
WANK	*Same	Salisbury, N. C.	1706	1000
WANL	*Same	Elizabethtown, N. C.	1706	1000
WPGG	State of Ohio, Dept. of Highways, Div. of Highway Patrol	Findlay, O.	1682 1596†	500
WPGQ	Same	Nr. Columbus, O.	1682 1596†	400
WPHC	Same	Nr. Massilon, O.	1682 1596†	400
WPHK	Same	Nr. Wilmington, O.	1682 1596†	400
WPHT	Same	Cambridge, O.	1682 1596†	400
WQFT	Same	Portable	1682 1596†	400
KOHA	State of Oregon, Police and Highway Dept.	Astoria, Ore.	1706	50
KOHB	Same	Baker, Ore.	1706	10
KOHC	Same	Coquille, Ore.	1706	50
KOHD	Same	The Dalles, Ore.	1706	50
KOHE	Same	Eugene, Oregon	1706	10
KOHF	*Same	Portable-mobile	1706	10
KOHG	Same	Grants Pass, Ore.	1706	10

* Construction permit issued.

† Denotes conditional and temporary on this frequency.

STATIONS OPERATING IN THE EMERGENCY SERVICE

STATE POLICE STATIONS—*Continued*

Call letters	Licensee	Transmitter location	Frequency (kc.)	Power (watts)
KOHH	*State of Oregon, Police and Highway Dept.	Portable-mobile	1706	10
KOHI	*Same	Portable-mobile	1706	10
KOHJ	*Same	Portable-mobile	1706	10
KOHK	Same	Klamath Falls, Ore.	1706	1000
KOKL	Same	La Grande, Ore.	1706	1000
KOHM	Same	Milwaukie, Ore.	1706	50
KOHN	Same	Bend, Ore.	1706	50
KOHO	*Same	Portable-mobile	1706	10
KOHP	Same	Pendleton, Ore.	1706	10
KOHR	Same	Roseburg, Ore.	1706	50
KOHS	Same	Salem, Ore.	1706	1000
KOHU	Same	Burns, Ore.	1706	50
KOHV	*Same	Portable-mobile	1706	10
KOHW	*Same	Portable-mobile	1706	10
KOHX	*Same	Portable-mobile	1706	10
KOHY	*Same	Portable-mobile	1706	10
KOHZ	*Same	Portable-mobile	1706	10
WAMF	Commonwealth of Pennsylvania, Pennsylvania State Police	Portable-mobile	1674	500
WBA	Same	Harrisburg, Pa.	190	300
WBR	Same	Butler, Pa.	190	300
WDX	Same	Wyoming, Pa.	190	300
WJL	Same	Greensburg, Pa.	190	300
WMB	Same	W. Reading, Pa.	190	300
WPSP	Same	Harrisburg, Pa.	1674	1000
KGZE	City of San Antonio and State of Texas	San Antonio, Tex.	2482	500
KNFC	State of Washington, Dept. of Fisheries	Vessel "Governor Isaac I. Stevens"	2490	50
KNFD	State of Washington, Dept. of Fisheries	Vessel "Governor John R. Rogers"	2490	50
KNHA	Same	Vessel "Governor Eliza P. Ferry"	2490	50
KACB	State of Washington, Highway and Patrol Dept.	Portable-mobile	2490	10
KACG	Same	Portable-mobile	2490	10
KACH	Same	Portable-mobile	2490	10
KACQ	Same	Kalaloch, Wash.	2490	10
KACW	Same	Portable-mobile	2490	10
KADU	Same	Portable-mobile	2490	10
KGHA	Same	Portable-mobile (snow-plow)	2490	10

* Construction permit issued.

STATIONS OPERATING IN THE EMERGENCY SERVICE

STATE POLICE STATIONS—*Concluded*

Call letters	Licensee	Transmitter location	Frequency (kc.)	Power (watts)
KGHB	State of Washington, Highway and Patrol Dept.	Portable-mobile (snowplow)	2490	10
KGHC	Same	Portable-mobile	2490	10
KGHD	Same	Seattle, Wash.	2490	50
KGHE	Same	Snoqualmie Pass, Wash.	2490	50
KGHQ	Same	Chinook Pass, Wash.	2490	10
KGHR	Same	Portable-mobile	2490	10
KNFG	Same	Olympia, Wash.	2490	50
KNFK	Same	Bellingham, Wash.	2490	50
KNFL	Same	Shuksan, Wash.	2490	10
KNFQ	Same	Skykomish, Wash.	2490	10
KNFR	Same	Mobile (snowplow)	2490	10
KNFS	Same	Portable-mobile	2490	10
KNFT	Same	Mobile (snowplow)	2490	10
KNFU	Same	Mobile (snowplow)	2490	10
KNFV	Same	Mobile (snowplow)	2490	10
KNFW	Same	Mobile (snowplow)	2490	10
KNFX	Same	Ellensburg, Wash.	2490	10
KNFY	Same	Bear River Camp, Wash.	2490	10
KNFZ	Same	Hells Crossing Camp, Wash.	2490	10
KNGA	Same	Satus Pass Camp, Wash.	2490	10
KNGB	Same	Yakima, Wash.	2490	10
KNGC	Same	Vancouver, Wash.	2490	50
KNGD	Same	Walla Walla, Wash.	2490	10
KNGQ	Same	Wenatchee, Wash.	2490	50
KNGR	Same	Spokane, Wash.	2490	50
KNGZ	Same	Ephrata, Wash.	2490	10

impossible to signal from any one centrally located transmitter to patrol cars throughout the state. The impracticability of such an arrangement, it is said, for the Pennsylvania State Police and state-wide broadcasts has been demonstrated. Pennsylvania's problem, however, like those of several other states now interested in a state-wide radio communication plan, is not impossible of solution.

The essence of the problem is the definite limit to the efficient coverage of a radio transmitter. Its effective service radius is rigorously circumscribed by frequency and power factors, as well as other conditions affecting radio transmis-

sion in general. It is the opinion of radio engineers that a large state, such as perhaps Kansas or Oklahoma, could not be adequately served by even a high-powered station placed in its center, because of the failure of the ground wave to carry reliable transmission to all corners of the state at all times of the day and night, in all seasons, and under all conditions.

The general principles governing use and operation of municipal police stations may also be applied to state police stations. The frequency available for use by a state police station may be determined by inquiring at the office of the Commission, since frequencies have been allocated to states in the same manner as to the areas for municipal police stations. The maximum power which may be authorized is 5000 watts sunrise to sunset and 1000 watts sunset to sunrise.

The establishment of a state police radio system is a much more complicated problem than the establishment of a municipal police radio system. In order to be of maximum utility a state police radio system should be able to reach police officers wherever located within a state at any hour of the day or night. In order to achieve this result with the minimum number of stations and the least expenditure of funds a field-strength survey of the state is most desirable. In all probability the cost of making such a survey will be more than repaid by resultant savings. For instance, there is around each radio station a territory known as the "fading wall," in which fading is so intensive that irrespective of power the signals from that radio station are of very little utility. It is, therefore, unnecessary to provide for the emission of any amount of power greater than that required to provide twenty-four hour service at the inside boundary of the fading wall. If as a result of a field-strength survey it is found that this range can be achieved by the proper use of a 1000-watt transmitter the installation of equipment capable of greater emission would be unnecessary and uneconomical.

A promising relief for this situation is afforded through the engineering of a transmission system in which a plurality of transmitters of comparatively low power are distributed

throughout a state and connected to a central control point by direct remote control lines or by the conventional teletypewriter network. As previously noted, installations of this type are already in operation in both Chicago and New York, where the metropolitan area to be covered precludes the use of only one transmitting station.

With a sufficient number of low-powered transmitters placed at strategic points throughout a state, an alarm could be spread out over teletype lines simultaneously to the decentralized control points, and from there broadcast to mobile patrol units over the entire area within the space of a few minutes. With such a system in operation, the strength represented by the combined police forces of the state could be mobilized, placing highway control points under surveillance or taking other necessary measures, without loss of time. Here again, two-way radio communication becomes a necessary link in the modern police system. With mobile units equipped with portable transmitters, officers in direct pursuit or otherwise in possession of vital information, would be in constant communication with their local station, by which means additional facts and information would be exchanged and teletyped ahead for broadcast to other cruising units in the area. These mobile police stations have been found of great utility in connection with the establishment of temporary state police headquarters to cope with local emergencies such as might arise in connection with a fire, flood, earthquake, or similar general disturbance. In at least one state, mobile state police units are equipped with radio transmitters for use in communication with police headquarters when patrolling remote roads and areas otherwise not furnished with communication and in which an emergency might arise. Thus, teletype for the simultaneous relaying of information between fixed points combines with broadcast to mobile units, to provide a regional system capable of covering any area, regardless of size.

Under modern conditions, the police problem has become so complex that no one community may ever again hope to cope singlehanded with the criminal and his operations. The

times call for a merger of interests on a scale which will permit the effective coördination of police action along a wide front. The situation in and around Chicago, Cincinnati, or Los Angeles is not unlike that of almost every other section of the United States. Everywhere, cities and communities are nested so closely within compact areas that, considering their identity of interest and objectives, it is surprising indeed that their resources have not before this been combined into a powerful, unified government of metropolitan proportions. Meanwhile, until some greater transformation takes place, political boundary lines must be, in some measure, swept aside. The crime rate of a given community is, in large degree, a function of the territorial unit, of which it is only a part. With more than seventy-five regional radio communication systems already in operation, and their number constantly growing, the means are rapidly being adapted to the end desired.

THE USE OF MAPS

The regional police-communication system is dependent for its full success upon the existence of a plan for concerted action. Coördination is the very essence of the regional police system and is its only objective. Police forces in a regional organized area have an opportunity to develop in advance an adequate plan of operation, so that in emergencies the combined force can be quickly mobilized and placed in the field as one powerful unit. The value of maps in planning the fastest possible concentration of patrol strength is so marked as to rank them among the most important of all communication accessories. Every patrol movement (and this is as true for the individual community as for the region) involves the inspection or surveillance of given areas, and it is important that the police have exact information immediately available with respect to the terrain, the location and kind of arterial highways, laterals, streams, railroads, bus lines, streetcar systems, canals, ferries, bridges, underbrush and forested areas, mountain passes, buildings, and factories, as well as other similar information. In the control and dispatching of patrol

cars in the regional area or in the individual community, the preparation of satisfactory maps is the only possible means of cataloguing this important information so that it will be instantly available when an emergency arises. Such maps are also of invaluable assistance in the normal distribution of the patrol force and equipment.

Police departments may gain much by a study of the many various uses of maps in military service. Besides their obvious value in open warfare and in military campaigns, they are employed daily by military students in the solution of tactical military operations. The thoroughness with which the military force makes use of them is shown by the enormous amount of detail which is recorded on military maps. Reference to a military map will therefore suggest many points of value. Military and police service have much in common and the greater number of military hazards are also present in the organized patrol of a regional area as well as in the policing of a single community.

Aerial photographs, when properly taken, serve many of the purposes of maps and are in many ways even more useful than maps. They supply to the untrained person much of the information that the trained mind reads from a topographic map and, in addition, supply details and relations that an ordinary map cannot depict. Aerial photographs have the advantages of range of action and wealth of detail and they are extremely useful when the accurate location of objects is desired.

Photography from the air had been developed and used in a limited degree before the World War, but with very few exceptions the work was done from kites, balloons, and dirigibles. Aerial photographs of European cities had been used in the illustration of guidebooks and some aerial photographic maps of cities had been made, notably by the Italian dirigible-balloon service. Kites had been employed with success to carry cameras for photographing such objects as active volcanoes, the phenomena of which could be observed with special advantage from the air, and which were usually situated

far from balloon or dirigible facilities. In this prewar work, some scientific knowledge had been gained concerning photographic conditions from the air. Aerial photography made its greatest strides, however, in the war. Photographs taken from airplanes were used extensively in the construction of maps of enemy territory. Extremely useful maps were produced in this manner, containing an immense wealth of detail which could not have been recorded in any other way.

The volume of work performed by the photographic sections of the military air service steadily increased until, toward the end of the war, it was truly enormous. The aerial negatives made every month in the British service alone numbered scores of thousands, and the prints distributed in the same period numbered in the neighborhood of a million. The task of interpreting aerial photographs became a highly specialized study. An entirely new activity—that of making photographic mosaic maps—usurped first place among topographic problems. Toward the close of the war, scarcely a single military operation was undertaken until aerial photographic information had first been obtained.

The strategic importance of aerial photographs in military service should convince even the most skeptical of its many practical uses in police service. In warfare, aerial photography has been depended upon to discover the objectives for artillery and bombing, and to record the results of subsequent "shoots" and bomb explosions. The exact configurations of front-, second-, third-line, and communicating trenches, machine-gun and mortar positions, the "pill boxes," organized shell holes, listening posts and barbed-wire entanglements, were all revealed, studied, and attacked entirely on the evidence of the airplane camera. An ordinary map of a city or rural area is, if it is complete, a labor of years. A modern city is always dangerously near to growing faster than its maps. An aerial map, however, can be produced in a few hours. Paris was mapped on 800 plates in less than a day's actual flying. Washington was completely mapped in 2½ hours with fewer than 200 exposures, and recently in Rochester, N. Y.,

only one hour and twenty minutes and a total of eighty-two exposures were required. In most cities there are professional aerial photographers who are experts in this type of work and who invite consultation on such projects.

The police emergency is forever characterized by the demand for rapid and intelligent action. The communication system provides the means by which members of the decentralized force may be informed of the emergency, but the problem does not end there. The area concerned must be carefully analyzed, control points identified, police hazards and other information segregated and classified in a systematic manner, and the rapid concentration of patrol strength PLANNED, if the communication system is to yield the results for which it was designed, and which it is capable of giving. Maps of the beat, precinct, division, of the entire city, and of the larger surrounding area, are an excellent basis for the formulation of such plans.

Chapter VII

THE POLICE TELETYPE NETWORK

Teletypewriting is typewriting by wire. The distance, whether a few feet or the width of a continent, makes no difference; the results are the same—accurate, fast, and reliable transmission of orders and information from one point to another.

The uses of teletypewriting are many. It gives rapid and continuous service to newspapers and meets the demands of financial organizations for a flexible and foolproof mechanism in the handling of transactions that are frequently of world-wide importance. It fits into the methodical, ceaseless grind of the economic world, supplying an invaluable communication facility for all the fields of industry and manufactures and for commerce. The teletypewriter is to be found at landing fields of the national airways and in the weather-bureau offices and radio stations of the United States Department of Commerce, where it is used to transmit weather information that is important to the safety of air navigation. Since its first introduction into police work in 1922, its use in law-enforcement activities has expanded rapidly, and it has consistently proved its worth in the solution of two major police-communication problems, namely, contact between headquarters and substations, and interdepartmental communication.

The teletypewriter is an electrical machine into which are built the keyboard, carriage, and certain other parts of the typewriter. When a sending machine is connected by means of telephone circuits with other machines equipped for receiving, it controls the equipment in such a way that any message written on the sending machine is instantly reproduced in typewritten form at all receiving terminals. There are machines for sending, machines for both sending and receiving, and equipment designed for receiving only. Land-wire connections are made over leased telephone lines or privately controlled circuits. The service may be installed and

maintained by the telephone company in much the same manner as telephone service.

The teletype machine is of two kinds, the page printer, and the tape printer. The page machine accommodates stationery 8½ inches wide, either in a long continuous roll or in separate sheets; when rolls are used, the paper is fed automatically into the machine. An original and several carbon copies may be made on either the transmitting or the receiving machine, or on both of them. If an error is made when sending with a page machine, it can be crossed out at the sending station and the correction will be made simultaneously at the receiving terminal. The tape machine types on tape, and automatically feeds the tape from a roll. The tape is three-eighths of an inch wide. Any work that can be done on the conventional typewriter, such as reports, messages, orders, statistics, and similar material, can also be done on the teletypewriter. The kind of work to be done determines the choice between the page and the tape printers. In police work the page printer is preferred, since it types the transmitted and received messages in a convenient form for filing and record purposes.

The capacity of the machine is from 40 to 60 words a minute. When an operator types a message on a transmitting teletypewriter, the sending mechanism converts the letters of the alphabet, also the necessary typewriting functions, such as paper feeding, carriage returning, and spacing, into groups of electrical impulses. These groups of impulses, originated at the sending machine, are transmitted over telephone circuits by means of different current values. The signals received over the line actuate selecting devices in the receiving machine corresponding to the transmitted character and cause this character to be reproduced.

The selecting code apparatus which causes the receiving machine to print employs five signal elements for each character. This five-unit code device, worked out in terms of two-current values over the connecting telephone lines, provides thirty-two possible combinations. For example: let A represent one current value and B the other; one of the possible

combinations is therefore A–B–B–B–B, another would be A–B–B–B–A; and so on. One of the five-unit combinations is assigned to each of the twenty-six letters of the alphabet, leaving six combinations for the typewriter functions. Combination 27 causes the type mechanism to space without printing. Combination 28 returns the carriage when the end of the line

Switchboard and associated teletypewriter: Harrisburg installation, Pennsylvania State Police teletype network.

is reached; 29 feeds the paper upward. Combination 30 operates the shift key, and combination 31 moves the shift, so that, as in an ordinary typewriter, two sets of characters on the type bars are available for use. Combination 32 permits a receiving station to "break" or stop the sending operator when the receiving station desires to answer. If receiving-only machines are used, this last combination unit is not needed.

Since only one signal element can be sent over the line at a time, the five elements representing each character must be transmitted in succession. In order that five signal elements shall be properly identified at the receiving end of the line, the receiving mechanism runs in synchronism with the sending machine; thus each of the five signal elements controls

the proper selecting element in the receiving device. The sending and receiving mechanisms are driven by fractional-horsepower motors running at the same speed. The speeds are controlled either by the use of governors or through the installation of synchronous motors. These motors, which run continuously while the teletypewriters are in use, drive the transmitting and receiving mechanisms through friction clutches. The transmitting and receiving machines, however, are restrained from operating by mechanical arrangements which are released when the first line signal is received. In order to accomplish this starting function, the five selecting signal elements are therefore preceded by a signal element of a current value opposite to that of the line in idle condition.

The receipt of this first signal at the receiving teletypewriter starts the printing cycle. The five selecting elements which follow the starting signal select the proper character and cause it to be printed. Following the selecting impulses, a seventh signal element is transmitted over the line, which causes the receiving mechanism to stop at the completion of the printing cycle. When the next group of signals is received, the cycle is repeated.

Under this arrangement, the receiving mechanism does not start until the first impulse is received, and it stops at the completion of the cycle. The sending and receiving mechanisms thus remain in synchronism only for one printing cycle. Teletypewriters are usually arranged to type at 60 words a minute, or, roughly, 6 letters a second, and synchronism can be accomplished without rigid requirements in respect to the speeds of the teletypewriter motors.

Besides simplifying the manner of maintaining synchronism, the start-stop principle makes it possible for two stations to communicate irrespective of the distance between them, or of the lag introduced into the signals by intervening circuits or apparatus. The selecting signal elements are always transmitted and received in the same time relation to the start impulse which controls the beginning of the printing cycle.

In the design of teletype systems for police use, special arrangements are frequently required in order to meet conditions peculiar to police operations. There is, for example, a starting and stopping arrangement when communications are to be intermittent. Service is thus made available at any moment without the necessity of continuous operation. Another arrangement of particular value in police work is the use of a loud alarm that is provided for patrol booths or other places where the officer is not always within hearing distance of the usual calling signals. Special switchboards are available, equipped either with keys or with cords and plugs, and designed to meet the requirements of a particular police organization. In state-wide systems, the stations are frequently divided into zones, with each zone under the control of an individual switchboard. In crime emergencies, when it is desirable to make a state-wide broadcast from general headquarters, what is called a seizure circuit may be set up, whereby the operator at headquarters may take control of, or seize, the broadcasting circuit of any or all zones throughout the area covered by the network. There are also acknowledgment circuits (which permit stations to acknowledge the receipt of a message), selective calling arrangements, and various systems of laying out circuits so that some stations may send, some send and receive, and others receive only.

If teletype connections are few and messages infrequent, only the individual machines and interconnecting lines are required. As the scope and use of the service enlarges, it is necessary to set up a central exchange for convenience in making the desired connections. The teletype switchboard fulfills this purpose. At zone headquarters, or in the central division offices of a police department, a specially designed PBX switchboard may be provided for the dispatching of teletype messages.

The first switchboard designed for broadcasting information from a central station to outlying stations was a 24-line radial system which supplied one-way transmission, the outlying stations being equipped with receiving-only machines.

This type of switchboard may be used by one or two operators, depending upon the volume of message traffic. The next step in teletype switchboard development was taken by the New York Police Department, in which each borough headquarters broadcasts both to its own local precinct stations and to other borough headquarters. (The complex system of the New York police will be described later under a discussion of precinct systems.) New arrangements were incorporated into teletype construction, including the acknowledgment key and the general broadcast or "break" key.

A later development provides for intercommunication between outlying stations. This cannot be accomplished merely by connecting the two lines together at the switchboard, because teletypewriter operations require that the line current be held to approximately a constant value. A simple connection of two lines would change their impedance and thus the current flowing, so that the insertion of a single-line repeater is required at the switchboard. An experimental installation in a large industrial concern was found to be satisfactory. With this system, the outlying stations are equipped for sending as well as receiving, and PBX may be called by operating a key at the outlying station. The central operator then connects the calling station to any other desired. Broadcasting is also provided for, as in the older installations.

Frequently, it is desirable to send a message to a station when no attendant is present. For this purpose, it is necessary to have some means of starting the motors of the machines at substations from the headquarters switchboard. The transmitting circuit or a second channel may be used to do this. Modifications are often required of the standard switchboard, because of special conditions in certain organizations.

THE TELETYPEWRITER IN POLICE SERVICE

Combining the speed of the telephone with the accuracy of the printed word, the teletypewriter has become an established and vital link in the police chain of communication. Through the rapid transmission of information to a single point, or

simultaneously to any number of stations, it often supersedes the telephone and supplements the functions of the radio communication system. It holds promise of continued expansion as a means for rapid communication between headquarters and substations in metropolitan police systems, and for the solution of many territorial communication problems which confront the police.

THE MUNICIPAL SYSTEM

In the decentralized form of police organization to be found in large metropolitan departments, the teletype network is an effective instrument for the coördination of a far-flung force into one composite unit. Between headquarters and substations it supplies a rapid and accurate system of communication.

As an aid to administrative activity, it makes possible the speedy and reliable transmission of departmental orders, instructions, personnel notices, important announcements, orders concerning the distribution of the force and equipment, and other information, from the executive branch of the department to commanding officers at substations. By the same means, substations may quickly dispatch crime summaries, daily, weekly, and monthly reports, statistical reports, personnel information, and other data concerning the individual district or precinct to central headquarters, where this information may be used in correlating the needs of the police department and directing its operations to the best advantage. The time required for the transaction of such routine business is thus reduced to a minimum with the result that the demands of the emergency may be promptly and adequately met.

In emergencies the teletype system is an effective agency for the prompt dissemination of crime information and operating instructions to substations. It offers a ready means for dispatching detailed descriptions of missing or wanted persons, lost, found, and stolen property, stolen automobiles, crime reports, and other emergency information.

A call for police assistance arriving in the central complaint room may or may not require radio broadcast, depending entirely upon the situation reported. In either event, however, the teletype system comes into play most effectively. This is best illustrated by tracing two typical calls. A citizen in a hurried report over the telephone informs the police operator that his store has just been entered and robbed by three men who escaped in an automobile. Details of the crime are given in brief and without delay to all patrol units, by radio broadcast. A supplementary message is then sent out to all substations by teletype, containing a more detailed report of the crime, together with such other information as may be helpful to commanding officers in directing the men working out of their respective stations. The second call may be a complaint of a barking dog in one of the precincts, or some other matter not requiring broadcast by radio. Such reports, of which there are many in the course of an average tour of police duty, are quickly relayed by teletype to the stations of the districts in which the reports originate, and are there assigned to patrol officers for investigation. Working between the two extremes illustrated, the teletype system provides for an unobstructed flow of both routine and emergency message traffic, and is an effective agency of commmunication in administrative activities, besides.

The teletype system of the police department of Baltimore, installed in October, 1930, is fairly representative of the municipal network. The equipment used in this installation consists of one 10-line, two-way switchboard, and nine page-type sending and receiving machines. Two of these machines are at heaquarters and the remaining seven in the precinct stations, which are placed at strategic points throughout the city. The control arrangement permits headquarters to send a message to any one of the precinct stations individually, or to any group, or to all the precincts simultaneously. Not more than two communications to or from headquarters may be in progress at the same time. The precinct stations may communicate with each other through the headquarters switchboard, but

such communications are limited to one at a time. Not more than two district stations may be connected with each other at the same time. There are fourteen substations throughout the outlying sections of Baltimore. These offices, under the supervision of the district stations, make use of the telephone in conveying urgent messages to headquarters, whence flashes may be broadcast over the entire city through the teletype system.

The San Francisco Police Department owns and maintains a teletypewriter system comprising a 20-line switchboard, two page-type sending and receiving machines, and seventeen receiving-only sets, all set up within the city limits and maintained by the city's Department of Electricity. The city owns its own circuit facilities, with the exception of one cable pair (extending between the Hall of Justice and the Bayview Police Station) which is provided by the telephone company at its customary charges for such facilities. The circuit is operated on a speed basis of 40 words a minute, and ordinarily all stations are connected by the circuit, although the switchboard is arranged for individual or group selection.

Teletype service has been in operation in the Boston Police Department since 1927. This facility permits the Boston Police Headquarters to transmit typewritten messages instantaneously to all its twenty-one divisional stations scattered throughout the city. Headquarters makes use of page-type sending and receiving equipment; substations are equipped with receiving-only machines. The neighboring communities of Arlington, Brookline, Cambridge, Medford, Melrose, Quincy, and Somerville have connected their police departments by teletype with the Boston system, and have also established communication among themselves.

In the early part of 1929 a teletype system was put in operation by the Buffalo Police Department. It consists of two page-type sending and receiving machines installed at general headquarters and sixteen receiving-only machines installed respectively at each of the sixteen precinct stations in Buffalo. By means of a radial switchboard, headquarters can

send message traffic to any one, or to a selected group, or to all the precinct stations simultaneously. Various kinds of police information, such as descriptions of missing persons, information concerning lost or stolen articles, orders for arrest, general reports, and general alarms are transmitted over this network with accuracy and dispatch.

The installation in the New York Police Department is necessarily more complex, but is none the less effective. New York is divided into five boroughs, Manhattan, Brooklyn, the Bronx, Queens, and Richmond. For each borough there is a separate police command with a headquarters office. General police headquarters for this great metropolitan area is situated in Manhattan, and the precincts in this borough are controlled directly from general headquarters. The other four boroughs are divided into precincts, each with a police station, and connected with the borough headquarters by teletype.

There are 109 page-type machines in the New York system, which provides for two-way teletypewriter service between general police headquarters and the four outlying borough police headquarters, and one-way service from each borough headquarters to its associated precincts, traffic squads, and special service points. At general headquarters, four receiving-only machines handle messages from borough headquarters, and one receiving-only machine at each of these borough stations handles messages from general headquarters.

In each borough headquarters a switchboard with tie lines permits two-way service between each borough station and the receiving-only sets in its associated precincts. Each switchboard has associated with it two sending-receiving machines, one normally used for one-way service and the other for two-way communication. The functions of these machines may be interchanged, or one set may serve both purposes if desired. The system provides the following services: (1) switchboards enable the operators to select and send messages to any one machine, to a group of machines, or to all machines connected with the switchboards; (2) two-way communication is facilitated between general headquarters and the other four bor-

ough headquarters; (3) one-way communication is facilitated between each borough headquarters and each precinct in the borough; and (4) the receiving-only machines on the one-way lines are equipped with a switch for operation of a line lamp at the sending station in acknowledgment of the receipt of a message.

The teletypewriter is used in the New York Police Department for the transmission of messages pertaining to crime emergencies and the transaction of routine business such as descriptions of persons, information regarding lost or stolen property, orders for arrest, general reports, subpoenaing patrolmen to appear at the various courts, and adjustments and assignments of the police force.

The information transmitted is of two kinds: first, that of general importance to all divisions of the force, transmitted by general headquarters to the other boroughs, from which points it is communicated to the precincts, if they are involved; and second, that of concern to one borough only.

Messages classed as alarms are numbered serially, starting with January 1 and ending with December 31, of each year. This numbering arrangement, acting as a check, enables precinct commands to be sure of receiving all alarms, and facilitates cancellations when necessary. The average daily number of crime alarms transmitted over this system is eighty, exclusive of routine messages, reports, and instructions.

The value of the municipal system, however, is not limited to rapid, local police communication. The greater number of municipal installations are connected by direct wire with territorial teletype networks, so that the municipal system becomes an important unit in a larger and more comprehensive system of police communication. In the regional coördination of police activities, the teletypewriter occupies an enviable position as an agency for the instantaneous communication of emergency alarms to fixed points over a large area.

As indicated in an earlier chapter, in the ultimate solution of the problems attending radio transmission over wide areas teletype networks will doubtless be used for the dissemination

of crime information to fixed stations strategically placed in the regional area, from which points the alarm will be broadcast to mobile patrol units in the immediate territory by low-powered transmitters placed at the individual teletype control points. The regional teletype system also affords a means for rapid clearing of routine reports and information, activities connected with criminal identification, and other similar details, which must otherwise suffer the delay of handling by mail, or the expense of transmission by commercial telegraph.

COUNTY TELETYPE SYSTEMS

The teletype installation in Essex County, N. J., is of particular interest, for it ties not only with the New Jersey state-wide system, but also with the New York City system. With Newark as headquarters, twenty-two municipalities in the county are joined together through the teletypewriter. Through Newark, connection may be made with New York City, and, since the New Jersey state zone headquarters are in Newark, police forces of Essex County enjoy the facilities of a very extensive communication network.

Another county teletype installation which is connected with the New York City system, and which shows how promptly a regional system may be set up through the connecting of municipal, county, and state systems, is that in Nassau County, Long Island. The Nassau County police are responsible for patrolling all sections of the townships in that county not included within the limits of incorporated villages. At the request of certain of these villages, it has undertaken to police them also.

The Nassau County Police Department is divided into six precincts, with county headquarters at Mineola. The system consists of a 20-line switchboard at Mineola headquarters, from which two-way circuits, terminating in sending and receiving instruments, extend to each precinct headquarters. Two machines are provided at the switchboard for operating purposes. The switchboard is so arranged that the operator may select and send or receive messages to or from any station

connected in the circuit. Messages may also be sent simultaneously to a selected group of stations or to all stations in the system.

Through the coöperation of the Nassau County police, the police departments of a number of incorporated villages in the county are also connected with the county switchboard. These villages contract for the machines and connecting circuits, which are operated in much the same manner as the precinct circuits, previously described.

The Nassau County system is connected with the New York City police network by two one-way circuits. The circuit from the Mineola switchboard to New York City terminates in a receiving-only instrument at Manhattan headquarters, and a circuit from that point terminates in a receiving-only instrument at Mineola.

Messages or alarms received at any county patrol station are telephoned to precinct headquarters, and the message is transmitted to county headquarters over teletype lines. If the coöperation of New York City is desired, the message may be teletyped to Manhattan headquarters.

THE STATE-WIDE TELETYPE NETWORK

The Pennsylvania system.—The first state-wide police teletypewriter system was set up by the Pennsylvania State Police on December 23, 1929. The system comprises 110 machines operating continuously and connects 95 cities and 100 locations within the state.

The territory is divided into four zones, with central headquarters at Harrisburg, the state capital, and zone headquarters at Philadelphia, Pittsburg, and Wyoming. The equipment at each of these places consists of a 24-line-capacity radial teletypewriter switchboard and its associated apparatus, to which are connected one regular and one emergency page-type sending and receiving machine. In addition, one receiving-only instrument is placed at each of the zone headquarters and three at central headquarters. All other stations are equipped with receiving-only machines. Nine main chan-

nels radiate from Harrisburg to various parts of the state so that messages may be sent simultaneously to all stations on the system or, if desired, to stations on any one or more of these main channels which may be selected. Branch channels radiate from each of the zone headquarters so that each individual station may send to the other station in its zone. The channels between zone headquarters and central headquarters are arranged for simultaneous transmission in both directions.

The system functions as follows: A police officer in a town where a crime has been committed, telephones details of the emergency to his zone headquarters. Zone headquarters, by means of the teletypewriter, dispatches the information to all points within the zone and to central headquarters at Harrisburg. The information, upon its receipt at Harrisburg, is edited and, if important enough, is transmitted over the other channels, or such lines as may be selected, to distant parts of the state. Matters of general interest arising in the state police department at Harrisburg can be sent from that point to all other stations on the system.

A desirable and interesting result of the teletype installation is the closer coöperation secured between state and local police in Pennsylvania. Most of the installations connected with the system have been set up in municipal police headquarters, so that state-wide crime news becomes readily available to local police departments as well as to the state police.

The first incident to occur after the installation of the Pennsylvania state teletype system was the theft by two men of a large black sedan with green wheels, from a garage in South Philadelphia. Ten minutes after the robbery, a message went out from the City Hall over the local teletype system and to central headquarters in Harrisburg, from which point it was transmitted throughout the state. The message, designated by the police code as General 89-Ph 18, read as follows:

GENERAL 89 PH 18—MARCH 12 ARREST 2 YOUNG WHITE MEN—NO. 1 MAN 28 YEARS 5 FT 8 IN 150 LBS THIN BUILD—LIGHT

CAP BLUE OVERCOAT—THIS MAN HAD REVOLVER—NO. 2 MAN 35 YRS 5 FT 8 IN 135 LBS—LIGHT OVERCOAT AND LIGHT SOFT HAT RUDDY COMPLEXION—WANTED IN THE 25TH POLICE DIST PHILA FOR HOLDUP AT POINT OF GUN 10:30 THIS P M IN THE SOUTH FOURTH STREET GARAGE LOCATED AT 1822 SOUTH FOURTH STREET AND LARCENY OF A HUPMOBILE STRAIGHT EIGHT SEDAN—BLACK BODY GREEN WHEELS PENNA LIC NO. AND ENGINE NO. UNKNOWN—LATER MESSAGE WILL FOLLOW.

In the pocket of a state trooper leisurely patrolling the main highway through Greensburg there was soon reposing a typed description of a black sedan with green wheels, two men, one with a gun. A car drew up before a roadside restaurant and the occupants, two men, went in for refreshments. Ten minutes later, the following message was received over the teletype system at the City Hall in Philadelphia:

STATE POLICE AT GREENSBURG PA HAVE ARRESTED TWO MEN SENT OUT ON GENERAL 89 PH 18 AS WANTED IN THE 25TH POLICE DIST PHILA FOR LARCENY AND HOLDUP—PLEASE ADVISE.

Three hours after the commission of the crime, just the length of time that it took the two men to drive the stolen sedan across the state, they were taken into custody and arrangements were made to return them to Philadelphia for investigation and trial. This incident, taken from actual police records, is typical of the use that is made of the teletype system of police communication.

The New Jersey system.—The New Jersey State Police network spreads out from five teletype switchboards. There is one at state headquarters in Trenton, and one at each of the zone headquarters, in Newark, Morristown, Freehold, and Hammontown.

The state headquarters board has a capacity of ten circuits. One-way circuits extend from it to police stations in the vicinity of Trenton. These circuits terminate in receiving-only machines. Two-way circuits extend from state headquarters to zone headquarters. The outward path of these two-way cir-

cuits ends in a receiving-only instrument at zone stations. The return line from each zone station terminates in a receiving-only machine at state headquarters. Two sending and receiving teletypewriters are connected to the switchboard at the state headquarters, one of which is available for emergency use.

By operating the proper switching keys on the switchboard, the state headquarters can broadcast over any or all of the circuits extending from the board, that is, to any group of stations, or to all stations on the one-way circuits, or to any or all zone headquarters. Besides this selective broadcasting, the state headquarters may, by the operation of a timing key, automatically seize all circuits, including those extending from all zone headquarters switchboards, for the broadcasting of general alarms. When this timing key is operated, the sending machines at all zone stations are automatically removed from the sending circuit, thereby preventing the interruption of the message from state headquarters by the sending of another message from any zone station.

Switching keys at state headquarters permit the establishment of connections between zone headquarters through the switchboard at state headquarters. Switchboards at the zone stations each have a capacity of eighteen key-controlled one-way circuits. These circuits extend through the zone to police stations, where they terminate in receiving-only machines.

Connected to the switchboard at zone headquarters are one regular sending and receiving, one spare sending and receiving, and one receiving-only machine. By operation of the switching keys on the switchboard, a message may be transmitted to any group of stations connected with the board. All messages originating at zone headquarters are also transmitted over the two-way circuit to the receiving-only teletypewriter at state headquarters, so that the central station has complete supervision over all alarms broadcast over any part of the system.

The California network.—California was quite ready for the installation of a state-wide police teletype system since

there was already at Sacramento, the state capital, a well-established central bureau and clearinghouse for police information, namely, the Division of Criminal Identification and Investigation. The annual reports of this Division reveal

California police teletype network.

the scope of its activities and the invaluable assistance that it gives to California peace officers. Because of its position as a state-wide clearinghouse for police information, the Division was the logical nucleus for a comprehensive police teletype network, which now comprises twenty-four stations.

The equipment of the system consists of fifty-one page-type sending and receiving machines and four receiving-only instruments, connecting seventeen cities in California and one in Nevada, at forty-five locations. Operation is at a rate of 40 words a minute, and for the twenty-four hours of the day.

There are three control points in the system: the offices of the State Division of Criminal Identification and Investigation at Sacramento, headquarters of the Police Department of San Francisco, and the Sheriff's Office at Los Angeles. At these three points, specially designed cord-type switchboards are provided, from which radiate eight circuits connecting fourteen sheriffs' offices at as many county seats and seven police departments in California, also one city in Nevada, and two locations for the State Motor Vehicle Department.

Each of these switchboards permits a maximum of three two-way connections at one time. Provision is also made to permit of one-way transmission from any one of the three switchboards to all other stations of the entire system. In conjunction with switchboard equipment at the three control points, there are two service and one spare page-type sending and receiving teletypewriters, with one page-type receiving-only machine for monitoring purposes, which is used in connection with the through trunking circuit between the three control points. At the Sacramento control station, two monitoring receiving-only machines are used for this purpose.

In order to facilitate expansion of the system, other city and county police organizations throughout the state have been invited to connect with the system at their own expense. The telephone company will provide such connections under separate contracts with each respective police and sheriff's organization concerned. Under this sort of arrangement, several more cities will soon be connected with this system. Plans are under way for the extension of the network until every county seat and principal city in California will be part of the system.

The matter sent over the system falls into two classes: first, the message, and second, the broadcast. The message concerns

information in the hands of one department which, it is believed, would be of interest to another force; or it requests information which the receiving department may be able to give. It is usually of interest only to the sending and receiving departments, although, because of the kind of circuits used, it is received at all stations through which pass the wires connecting the sending and receiving stations. The broadcast consists usually of a description of a person, a vehicle, or other property wanted by the department sending the broadcast. Broadcasts may be sent only by the three switchboard stations called "control stations," and they are sent simultaneously to all stations on the system. In the first ten and a half months' operation of the system, to June 30, 1932, 51,111 messages were transmitted over the network, in addition to 4230 all-points bulletins. These bulletins were sent from a control station to all other stations on the circuit simultaneously, and represented the equivalent of approximately 80,000 additional messages.

THE REGIONAL SYSTEM

Municipal, county, and state teletype systems form the basis for widespread regional networks, and these in turn must, by the very nature of things, eventually constitute the foundation for a national police-communication system. Consider, for example, the New York municipal system. Direct teletype connections exist between Manhattan and the Connecticut, New Jersey, Massachusetts, and Pennsylvania state-wide teletype networks, thus establishing a five-state regional police communication system. A wide net can be flung out very quickly, since it is possible within the space of a few minutes to spread, in typewritten form, an alarm which would effectively cover this vast area.

The communication committee of the Northwest Association of Sheriffs and Police recently authorized an extended survey of the Pacific Northwest, with the object in view of developing plans for an interstate teletype system. The territory covered by the survey included the states of California, Oregon, Washington, Idaho, Montana, Nevada, and Utah, to-

gether with the Province of British Columbia. Since California, Oregon, and British Columbia are already operating state-wide systems, the dream of a Pacific Coast and Pacific Northwest network for police service may soon become a reality.

On June 18, 1931, at the International Anti-Crime Conference held in Seattle, Wash., an effective demonstration was given of the possibilities of the teletypewriter in interstate police communication and of the ease with which police departments thousands of miles apart could almost instantly spread information over vast areas that would facilitate prompt identification and apprehension of criminals. An international network of telephone lines, covering 7000 miles, carried messages from the conference to twelve states, a Canadian province, and fifteen cities scattered in various places across the continent. It was also demonstrated that, within three minutes after the report of an important crime was received by a police department, a crime summary of 120 words could be placed in the hands of law-enforcement officers in hundreds of cities. It should be noted, incidentally, that neither the number of stations nor the distance between them hinders the speed or efficiency of a communication.

In view of the growing importance of the Federal Bureau of Investigation at Washington, D. C., the significance and prophecy contained in this demonstration should set the pace for a future development when regional police networks will have been welded together in a national and even international police-communication plan.

TELETYPE MESSAGE ROUTING AND RECORD PROCEDURE

Exactness in operating and recording procedure is prerequisite to the systematic use of teletypewriter facilities. In the municipal system, individual departments may work out procedures to meet their particular requirements. In the territorial networks, however, such as state and regional systems, the operating and record practices should be uniform throughout the system. Uniformity indeed is imperative if the tele-

type communication system is to perform the services for which it is designed.[1]

The teletypewriter offers the authority and reliability of the printed message at both the sending and receiving terminals. Responsibility is definitely fixed by means of the printed form, and efficient record procedure becomes a comparatively simple matter. The teletypewriter supplies at all receiving stations an exact duplicate of the message typed on the sending machine.

The secrecy of communication possible with the teletypewriter commends it as a safe and expedient instrument. Since the sending and receiving mechanisms are on police property, and since the circuits are controlled by the teletypewriters and switchboards, no one without authority can possibly have access to any part of the system. The intervening wires between a sending and receiving machine cannot be tapped. Despite the distance which may separate machines, the messages sent over them can be kept as secret as a whispered consultation between detectives in police headquarters.

The population of a community has little or no relation to the need for teletypewriter service. An opinion too often prevailing, that only the police of the larger cities may profitably make use of modern communication facilities, is quite contrary to the truth. With the access to lines of a territorial network radiating out to small communities placed at strategic points in the area, the small police force of the township or village, individually powerless to cope with a major crime emergency in its vicinity, is supported by the potential strength represented by the entire network. Furthermore, the small local force becomes an effective unit in the regional system, ready to act immediately upon the receipt of emergency crime information from teletype control points. Thus the police function becomes a reciprocal one, and both the individual community and the territory as a whole benefit through the coördination of their activities.

[1] See Appendix 6, p. 508, "New York State Teletype System, Operating and Record Procedure."

In the large metropolitan system, the teletypewriter may become an agency of decentralization through the provision of a speedy and reliable means of communication between headquarters and substations for the relaying of administrative, routine, and emergency message traffic. Moreover, the metropolitan department, through its connection with county, state, and interstate systems, shoulders an even greater responsibility to surrounding police forces than does the small community. As a large identification center and depository for criminal records, the metropolitan organization can greatly assist the smaller departments in the area, bringing to bear upon given situations the full strength of its facilities for the detection and suppression of crime.

With the speed, flexibility, and accuracy provided through a teletype communication system, criminal identification becomes a weapon of growing importance in law enforcement. Suppose, for example, that a man makes application for a peddler's license at the city hall, and that he is suspected by detectives stationed there of being a former convict. Through the teletypewriter, it is possible to make inquiry about him, have the detailed records of the man examined, and receive full information concerning him within a comparatively few minutes.

There was, as a matter of fact, an actual incident of this kind, in which events happened so rapidly that the man under observation never suspected that anything was amiss. One detective chatted casually with the suspected man in a city hall corridor, while another dispatched a teletype message to the State Bureau of Identification, some seventy-five miles away. A reply clearing the man was received within fifteen minutes, and the two detectives showed the man the office that he had been looking for without revealing their connection with the police force. The utility of the teletypewriter in practical police service is strikingly illustrated by the teletype message exhibits shown in Appendix 7 (p. 523), which were taken directly from the files of the New Jersey State Police teletype system. These exhibits are designated in

series, each series giving the complete communication history of an actual police case under investigation.[2]

There is some evidence of failure on the part of the police departments within an area served by teletype communication to make adequate use of these facilities. The teletypewriter, with a transmission rate of from forty to sixty words a minute, can handle a tremendous volume of message traffic in the course of twenty-four hours, and police departments that have this facility available should make the most of it. The organizations at central control points should give the proper instructions to the forces in all the communities that are served directly or indirectly by teletype lines, and encourage its use as a major police-communication facility. Besides improving law-enforcement activities in the local community and in the territory at large, such a policy will draw favorable attention to the need for teletype networks in other sections where the police have not yet been able to obtain appropriations for the installation of this equipment.

The teletypewriter system will carry information to the receiving instruments, but unless provision is made for its distribution to patrol units, it will be of little value in the prevention and detection of crime or in the apprehension of criminals. It is here that the interlocking functions of the various police communication units are brought into play. Through radio broadcast and the recall and beat telephone systems, the crime report may be placed promptly in the hands of the individual motor and foot patrolmen, who, in

[2] Exclusively police-controlled teletype systems are now in operation in the United States as follows:

Municipal systems: Albany, N. Y., Baltimore, Md., Boston, Mass., Buffalo, N. Y., Chicago, Ill., Cincinnati, Ohio, Cleveland, Ohio, Detroit, Mich., Evanston, Ill., Kansas City, Mo., Los Angeles, Calif., Minneapolis, Minn., Newark, N. J., New York City, Norfolk, Va., Omaha, Neb., Philadelphia, Pa., Pittsburgh, Pa., Portland, Ore., San Francisco, Calif., Seattle, Wash., St. Louis, Mo., Washington, D. C., Winnetka, Ill., and Worcester, Mass.

County systems: Essex County, N. J., Hudson County, N. J., Los Angeles County, Calif., Nassau County, N. Y., Union County, N. J., Westchester County, N. Y., St. Louis County, Mo.

State systems: California, Connecticut, Massachusetts, New Jersey, New York, Pennsylvania, and Illinois.

the last analysis, must represent the department on the front lines of action.

In modern police organization, whether municipal, county, or state police administration, the basic unit of operation is the individual patrol area or beat. Upon these decentralized units rests the structure of the entire organization. The teletype receiving instrument is only a point of relay in the chain of communication between the victim or complainant and the patrol unit or units which may be of assistance to him. From that point, lines of communication must be open and available for immediate transfer of the information to members of the patrol force. Until the patrol or operating strength of the department is in possession of the essential information, all speed and efficiency of communication up to that point has been of little avail.

All indications point to a greater use of the teletypewriter. The time is not far distant when interconnecting systems will make it possible for all the police forces of the country to unify their strength in the detection and suppression of crime through the facilities of a national communication network.

Improvements in design and reduction in cost of units may make it possible to place receiving machines on the beat for the distribution of printed orders and information to members of the patrol force. Already the radio-controlled typewritten message in a cruising patrol car presents no difficulty. Two-way radio communication, now being rapidly adopted by police departments, may be followed by two-way radio-controlled typewriter service between the patrol car and the central station, and between the patrol cars themselves.

Chapter VIII

BURGLAR- AND HOLDUP-ALARM SYSTEMS

THE FIRST TRUE SAFE was introduced in New York in the early part of the nineteenth century, and soon afterward the race began between the safe-builders and the safe-burglars. Unfortunately, the cause of righteousness has not always been victorious, for the sciences and technical knowledge invested in the construction of burglar-proof safes were soon prostituted to the use of the expert cracksmen. When burglars worked with crude implements, only a minimum of ingenuity was required to frustrate them. The modern burglar, who comes to his work with gas-flame equipment generating 6000 degrees of heat at the tip and capable of biting its way through a 12-inch plate of steel at approximately 2600° Fahrenheit, presents a far different problem. The modern bank vault is the final expression of scientific knowledge and technique in the design and construction of an enclosure for the safe-keeping of money and other valuables, yet it is not impregnable.

As an example of the desperation, hard labor, and skillful direction employed in planning a bank attack, the methods used in the burglary of a Pacific Coast bank are illuminating. Apparently led by a structural engineer, architect, or someone familiar with the premises, the building construction, and the vault arrangement, safe-burglars tunneled for at least ten days through earth and concrete preparatory to drilling through a bank vault. These tireless workers entered the manhole of a storm drain, some five feet in diameter, at a point more than a mile distant from the bank. Right in front of the institution, they cut a hole two feet in diameter through the six-inch concrete wall of the drain and burrowed forty-six feet underground, excavating two tons of earth which they piled back into the drain, where the water washed it away. The tunnel ended in a vertical shaft under the inner vault, which was at the farther end of the bank floor. Here the burg-

lars drilled a hole upward through the twelve-inch reinforced concrete floor of the vault in which the funds of the bank were kept. The particular spot where they cut into the vault was the only space on the vault floor that was not covered by heavy index-file trucks, which were rolled into the vault by bookkeepers at the close of each day's business. Had the burglars deviated from their course by one foot, they would have found themselves underneath either the steel floor of the outer vault or one of the file trucks. They knew the route, for the tunnel turned on a five-degree bend from the thirty-foot point, indicating that their original course was changed in order to break through at the one free place.

For half a century, vault construction remained almost unchanged in protective strength. Some modifications were made to offset the introduction of nitroglycerin as a weapon of attack and mechanical details were refined, but the vaults as constructed were considered more or less satisfactory. Suddenly the appearance of the cutter burner, the fluxing rod, the electric chisel and hammer, and even the oxygen pipe, introduced almost overnight a hazardous menace that necessitated equally revolutionary changes in the structural design of vaults.

Prior to 1920, the materials used in security-vault walls, unless the walls were of extreme thickness, were given a secondary importance. In the smaller vaults, brickwork was frequently used and occasionally concrete with a few steel reinforcing bars. Most of the larger and more important vaults were of concrete heavily reinforced. In all of them, however, a steel lining constituted the chief resistance to attack.[1]

The principal weapons used in an attack upon a safe were drills, explosives, and the torch. Vault engineers and vault manufacturers accordingly concentrated their efforts on the

[1] The National Bureau of Casualty and Surety Underwriters, in its *Manual of Burglary, Theft and Robbery Insurance,* defines a vault of the highest classification that they have established, No. 10, as follows: "No. 10 Vault—lined throughout with steel at least 1½ inches thick, or of non-reinforced concrete or stone at least 54 inches thick, or of reinforced concrete or stone at least 27 inches thick."

development of linings which should combine, in several layers, drill-resisting materials with other materials designed to resist burning. These thicker linings cost more both in materials and in fabrication. The various combinations were tested in the manufacturers' shops and laboratories, but few, if any, extensive tests were attempted under conditions simulating an actual criminal or mob attack.

In 1920, preparatory to its program of branch-bank construction, the Federal Reserve Bank began a series of tests under the direction of Alexander B. Trowbridge, their consulting architect, in an effort to establish the relative resistance of all the known types of vault wall and lining construction, and to rate these resistances in terms of cost. The Federal Reserve tests were undertaken not to discredit any material or method, but merely to establish the relative values of materials available for vault construction.

The test walls were constructed by a reputable contractor under careful supervision, and the linings were built and submitted by leading vault manufacturers. Concrete consisting of carefully graded fine and coarse aggregates and fairly rich in cement was found to offer some resistance to all three methods of attack—drills, explosives, and the flame—provided that the steel reinforcement extended entirely through the walls and at right angles to the direction of attack.

Further experiments were conducted in the following year and details of vault-wall construction were determined which provided an increased protection, *but in all of them penetration was effected under time tests.* It is therefore a matter of record that the most modern bank vault, representing as it does the ultimate development in protective enclosures, is susceptible to penetration by the burglar equipped with adequate tools. In such a state of affairs, the burglary hazard of mercantile establishments, where the barriers to entry are much less formidable, may be readily appreciated. The jewelry store, the theater, and other commercial institutions are liable to attacks not only by the professional but by the amateur as well, since the locks on doors, windows, skylights, and

other points of entry, as well as the cracker-box safes and strongboxes usually found in these establishments are easily mastered by even the most unskilled operator. The ordinary home is known among burglars as a "knockover," so simply and easily may entry be effected.

There is a point, moreover, at which an increasing investment in material resistance to attack ceases to be profitable. Vault construction is costly and it mounts rapidly as the effectiveness is increased and the complexity of the devices multiplied. It isn't necessary to go far afield in order to discover that burglar-resisting materials can never be more than burglar-delaying materials. If the burglar has time enough—and by that is meant no more than a few hours—it is safe to say that no commercially practicable construction is impregnable against him.

THE ALARM SYSTEM

Nevertheless, whatever ingenuity can devise to delay the burglar must be applied. But the mere prolonging of the safe-cracker's or burglar's task is not protection. This delay must be so taken advantage of as to prevent the robbery. Obviously the first necessity, therefore, of modern burglary protection is an adequate alarm system which will deliver a signal to a source of help. Many banks invest thousands of dollars in massive steel vault equipment, chiefly for the purpose of impressing customers, and perchance the burglar, but spend nothing for alarm protection. The lack of economy, the actual loss, indeed, that is incurred through overinvestment in material resistance is rapidly becoming apparent as the value of the protective services afforded by the comparatively inexpensive alarm system is being more and more appreciated. With an efficient alarm system, a pasteboard box may be made more nearly burglar proof than a modern bank not so protected.

Simply stated, an alarm system consists essentially of a mechanical or electrical device, usually a combination of both, which will automatically produce a warning signal at some specified point simultaneously with an unauthorized ap-

proach or entry to premises so protected. The alarm system holds a key position in the modern police-communication plan. Notification of the attack is instantaneous, and, by virtue of that fact, the first two of the four periods[2] that occasion delay are at once eliminated. With direct lines from the exciting mechanism to the source of help, there is no need for a telephone call. Generally speaking, when the crime is burglary, there is seldom anyone who can make such a call. Through the alarm system, the request for assistance is automatically synchronized with the attack, and radio-equipped patrol cars may be concentrated in the vicinity almost before the perpetrators of the crime have had an opportunity to begin their work.

Before considering further the means which may be successfully employed for protection against burglary, it is necessary to inquire into the nature of the offense, since it possesses certain characteristics which have a direct bearing upon the design of alarm protection equipment.[3]

Burglary is a crime of stealth in which the first essential of success is the undetected entry, and the second is the element of time. After arrival at the premises, the intruder must have time to overcome all barriers that oppose his entry. In effecting the entry, he may have to touch and move a window, a door, a transom, a skylight, and use his hands on locks and other protective devices; and this opens up a wide field in the design of burglar-alarm equipment.

Because of its speed and silence of operation, the electrical circuit is the basis for all modern alarm-protection systems. The function of that part of a system of electrical protection which embraces defense against burglary is to sound or turn in automatically an alarm in the event of (1) the opening of any door, transom, window, skylight, show window, coal chute, or other means of possible entry (the system may be extended to include floor, ceiling, and wall areas); (2) an

[2] See p. 157.

[3] See *Uniform Crime Reporting Manual*, Part I, "Classification of Offenses," for variations in definitions of burglary and robbery among the different states.

attack on the vault walls, ceiling, floor, or door by torch, explosives, or other means; (3) an attempt to open the vault door at other than the regular hours, or in any other irregular manner; (4) an attack on any part of safes, desks, strongboxes, or other enclosures for money and valuables; (5) an attempt to cut the wires forming part of the alarm installation; or (6) any tampering with any part of the alarm installation.

All modern alarm systems consist essentially of (1) apparatus for manually or automatically setting the alarm circuits into play—the exciting mechanism; (2) transmission lines between the protected area and the point of alarm destination; and (3) visual or audible signal apparatus at the alarm terminal or destination.

BURGLARY DETECTION DEVICES

CONTACTING SURFACES

The simplest of all expedients designed to frustrate the burglar, that of contacting surfaces, is familiar to layman and expert alike. All devices in this category consist primarily of two electric contacts, the disturbance of which will actuate the alarm circuit by one of two methods, the open circuit and the closed circuit.

The open circuit.—In principle the open circuit is exactly what the name implies. This rudimentary form of electrical protection includes the exciting unit, which in the circuit is the open contact, a source of current supply, and the terminal alarm-signal device. Its most significant function, however, is the opening of the circuit at the location of the contacts. Normally, no current flows through the alarm circuit. Contact surfaces are attached at doors, windows, skylights, and other strategic points in such manner that the unauthorized entry of an intruder will bring the two surfaces together, thus completing an electrical connection which closes the circuit and permits a flow of current to the terminal alarm signal. Although the open circuit is the most simple of all in design and construction, it has the serious disadvantage that

the circuit wiring may be cut or otherwise tampered with, resulting in a complete paralysis of the system.

The closed circuit.—In the design of modern alarm systems generally, the closed circuit possesses marked advantages over the open circuit. It overcomes the principal weakness of the open circuit because the alarm signal is thrown into operation by an opening of the circuit. Any tampering with or cutting of alarm-circuit wires therefore results in an instantaneous signal at the alarm terminal.

Relays or galvanometers installed in this circuit to start the alarms are so adjusted that any marked increase in resistance with a consequent decrease in current value, or any decrease in resistance with a consequent increase in current value, causes them to operate. The function of these relays is to transform into alarms the breaks or grounds on the electrical wiring that are caused by mechanical interference. They consist of an electromagnetic coil, responsive to changes in potential, the armatures of which close circuits of bells, lights, and other registering or indicating devices at the alarm terminal.

Such devices must be sensitive enough to respond to comparatively small changes of current value. They perform a function somewhat similar to that of a gauge on a pressure system. The movement of a sensitive gauge will indicate small fluctuations of pressure, plus or minus. All approved burglar-alarm relays are designed on a like principle, and the circuit becomes what is known as a balanced circuit. This arrangement offers effective protection against any attempt to "short-cut" the wires, substitute false lines, or any other method of circuit attack, since such disturbances would immediately upset the balance or equilibrium of the circuit and result in an alarm.

The galvanometer is perhaps more sensitive, but it is somewhat sluggish in action as compared with the relay. However, there is no great difference in their efficiency, and either type is used, depending upon consideration of battery sources and circuit. Where relays are used, they are in duplicate, one re-

lay being used as an overload and the other as an underload. The galvanometer is equipped with contacts on either side of the armature, so that a movement of the armature in either direction will short an alarm.

The contact form of exciting mechanism may consist of contact springs on doors and windows, tin-foil circuits on glass, wooden screens carrying concealed wiring, and wall protection consisting of lacing wire imbedded in wooden strips or foiling pasted on asbestos wall-covering material. These devices depend for their operation primarily upon the mechanical displacement of some part of the circuit, and they are particularly well adapted to the modus operandi employed in most forms of criminal entry.

Two general methods are used in the installation of the contact type of alarm-exciting mechanism in a bank or commercial vault. In one a grillwork of cables is used, and in the other the protective material is a lining. Where the grillwork installation is used, lead-covered wires or cables are imbedded in the masonry when the vault is built, tests being maintained continuously during their installation, and also during the pouring of concrete. The wires are generally set at approximately three-inch centers and are connected in different circuits, depending on the size of the vault, in such manner that no two wires of the same circuit are adjacent to each other. Linings are installed either on the outside or on the interior of the vault (the interior lining is better adapted to existing structures) in the form of a special sensitive material described as an "open and closed circuit lining," which in turn is covered by light steel plates to protect it against accidental penetration. Another form provides wires protected by some form of envelope other than steel, such as plaster, or other fairly firm material.

Anyone familiar with the characteristics of hard concrete knows that the cutting or breaking of this material requires the use of a sledgehammer, drill, or explosives; the forcing of a vault without breaking cables or penetrating the lining is not even probable. This method of protection, however, is

apt to be expensive and generally has been superseded by the use of sound- and heat-sensitive detectors installed on the interior of the vault.

SOUND-SENSITIVE DETECTORS

The evolution and perfection of the microphone in the telephone and radio industries made available a most effective instrument for burglary protection. These devices are extremely sensitive to sound waves of even low amplitude, and are now in wide use in modern alarm systems designed for protection against vault attacks.

Microphone detectors may be secreted at various places inside the bank, but are usually placed within the vault proper. Although the vault walls provide effective insulation against ordinary noise disturbances, these instruments are adjusted to pick up the slightest noise, and any attempt on the vault is promptly transmitted to the detectors, whether the attack is made by chiseling, drilling, or explosion. This type of detector is so sensitive that it is set in operation by the sounds produced by burning-tools, such as the acetylene torch and the electric arc. The slightest contact of the vault door, floor, ceiling, or walls, with hammer, drill, explosive, or other tool is sufficient to operate the sensitive microphone and speed the alarm to its destination.

HEAT-SENSITIVE DETECTORS

These devices have been widely adopted in fire protection, and they are excellent aids to burglary protection. A heat-sensitive detector is most useful when the burglar, in his attack upon the safe, vault, or other enclosure, employs the oxyacetylene torch, oxygen pipe, electric arc, or other heat-generating accessories which are the usual tools of the professional. It generally makes use of the familiar principles of either the thermostat or the thermometer. It is installed inside the vault or other enclosure, where any fractional-degree rise in the surrounding temperature is sufficient to throw the alarm circuit into play.

THE PHOTOELECTRIC CELL

This comparatively simple and powerful electrical protective device promises to play an increasingly important rôle in the design and installation of modern alarm systems. With a slight improvement in equipment and technique so as to secure the projection of these light rays over greater distances, its use will increase by leaps and bounds. It is adaptable to any standard current supply, and any number of positions can be protected from one control point.

The modern photoelectric relay, as used for commercial and industrial purposes, consists of a caesium-type photoelectric tube, the signal from which is amplified by a triode tube. The units are generally arranged to operate on an alternating current, a transformer supplying the necessary voltages for the various parts of the circuit. When light falls on the cell, the half-wave pulsating direct current in the plate circuit of the tube rises. Conversely, as the light reaching the cell decreases, the plate current drops almost instantaneously. An electromagnetic relay in the plate circuit is therefore operated each time the plate current changes. Relay contacts may be used to control any sort of local circuit, such as alarm signals, electric lights, motors, power switches, electric counters, door-openers and other devices, all through the mere change in the illumination falling upon the photoelectric cell.

In operation, this device is controlled by the illumination intensity of a beam of light falling upon its surface. A concentrated beam of light may, through the use of mirrors, be made to travel over a predetermined area, and its interruption by any object will cause a change in the output current of the light-sensitive cell. This change in output current results in the operation of the signal circuit proper. It is thus possible to blanket a protected object or interior with a screen of light of any desired shape. Penetration of the light wall by any object puts the alarm circuits into play.

Through the use of cells susceptible to the rays of invisible light, and certain light filters, it is possible to make the entire

control invisible. No object brought into the path of these rays can be seen as illuminated or casting a shadow. Such light walls of "black light," unknown and invisible to the intruder, automatically operate alarm circuits when penetrated or interrupted in any way. A system of this kind, in which invisible light rays are the basic principle of operation, is used to protect the Shah of Persia's jewels, which form part of the Persian Art Exhibition at Burlington House, in London. Two ornamental pedestals stand in front of the showcase that holds the Shah's jewels; one contains the lamp which projects the ray of invisible light, and the other holds what is termed the radio-visor bridge, or photoelectric cell unit. There is no outward sign of any protection, all the mechanical parts of the apparatus being concealed.

When, from any cause, the beam is obscured, a silent alarm is carried to predetermined points from which armed assistance may be instantly dispatched. As the ray gives no indication of its presence, it is impossible for the burglar to know where or how the device is installed. Any attempt to pass or reach beyond the invisible-ray barrier is thus frustrated. A finger, or the tip of an umbrella, is sufficient to break the circuit and send in an alarm. Any point of approach, such as windows, doors, staircases, corridors, or the approach to a safe, can be similarly guarded with photoelectric equipment already available. Two of the most recent installations in England were made at the International Exhibition of Persian Art and the Scottish Art Exhibition, but the system has already been installed in government offices, banks, warehouses, town and country houses, as well as numerous mercantile establishments.

RADIO-FREQUENCY CIRCUITS

The radio-frequency circuit is designed to detect and report the approach of an object through the amplification of changes in the inductive and capacitive characteristics of the surrounding air. A similar device makes use of changes in the electrical fields surrounding the object to be protected against

approach. Application of the radio circuit to alarm installations is based upon the fact that, if an object is brought near an oscillating circuit which is not shielded, changes occur in the tuning of this circuit. Such changes, known to all radio experimenters as being due to body capacity, cause very definite variations in the current characteristics of the circuits. These variations may be easily amplified and used to move the necessary relay apparatus. Essentially, the movement of an object, or any other variable factor in relation to the sensitive apparatus, causes a variation in the self-inductance or capacity of the oscillating system. This, in turn, brings about a variation in the period of oscillation, which is reflected in the operation of relays associated with the signal circuit proper. Experimentally, it has been possible with this type of apparatus to detect the presence of objects as they came within a radius of twenty feet.

Almost any scientific device that is sensitive to a fluctuation or change in surrounding normal conditions can be adapted to alarm-installation purposes. A student at Northwestern University, for example, recently constructed a burglary-detection device in which two heavily charged electrical coils were so disposed in a door frame that the intervening space was blanketed by a strong magnetic field. The passage of a person with a revolver or other metal object concealed in his clothing would put the alarm circuits in operation. Many other applications of this and similar apparatus are possible. The field of burglary-detection equipment presents to designers a rare opportunity for the refinement and perfection of alarm technique and operation.

In respect to the crime of robbery, however, the design of the exciting mechanism is more complicated, because, primarily, of the inherent characteristics of the crime. Robbery is an offense against both person and property. It has all the essential elements of larceny, with the additional requirement that the property must be taken from the person of the victim or from his immediate presence, and against his will, by means of force or fear. Let us therefore consider as briefly

as possible some of the conditions surrounding robbery before taking up the types of alarm protection against robbery that are in more or less common use.

The hazard of interior robbery captures the public attention because of the ingenuity of the attacks and the hazard to both property and life. The very methods of modern business make shops, theaters, banks, gas stations, and similar establishments easily accessible and susceptible to daylight robbery.

A question that disturbs the ordered thoughts of almost every banker is, How can he keep the doors swung wide in public welcome and still keep out the gunman? He invites personal consultations more than ever before, and this has stimulated architects and manufacturers of bank equipment to lower the counter screen; also to decrease the barriers between teller and depositor. (Likewise, the broad exposure of small retail premises to daylight raid is a direct result of modern relations between merchants and their customers.) As a guard against repeated holdups, one bank decided to keep its doors locked at all times.[4] Depositors must show the proper credentials before they can enter, and strangers are kept waiting at the door until they can be looked over by the town constable.

The comparative ease and suddenness with which the daylight robbery may be carried out has attracted the attention of the underworld. Many erstwhile professional burglars and criminals in other lines of endeavor have turned to robbery as a fruitful field, since they have felt that the risk and the labor are less when they can strike quickly, with drawn guns, and jump into a waiting automobile with the loot. The bank bandits of today rank among those criminals who rarely act on an impulse of the moment, but rather plan their crimes with the utmost care. Advance scouts are usually detailed to "case" the premises, and they are chosen not to participate in the actual holdup, but for their ability to analyze and report upon the strong and weak points in the routine, personnel,

[4] State Bank, Georgetown, Ill.

alarm equipment, and whatever police protection the bank may have. Time, secrecy, and fear are the essential elements in successful robbery. Where bonds, money, and other valuables are objectives, the criminal must strike fast and disappear quickly. The main requirement is speed.

Burglary, generally speaking, is an attack against property, and robbery is an attack against both person and property. It is essential in robbery that the criminal approach the victim personally, and by means of force or fear complete the crime. The average time required to complete a bank robbery is less than two minutes; a burglary may be a matter of a few minutes or, again, an entire week-end. A study made in 1923 of 150 bank robberies in Los Angeles revealed that, in almost every one of them, the offense was committed in less than three minutes. Furthermore, the burglar encounters any number of physical barriers in effecting entry; the daylight bandit walks through an open door.

The problem of placing the robbery-alarm circuits in operation is therefore more involved than is that of the burglar-alarm. In most of the holdup-alarm installations, the "touch off" is accomplished by means of contact devices such as push buttons and footrails placed at convenient points in the bank interior. There are many variations of this device, but they all require manual or pedal operation, usually by the victim.

This method of originating the alarm signal, although better than no protection at all, is open to serious criticism, since the victim may have to risk his life in order to send in the alarm. Bandits invariably warn their victims to this effect, and bank employees have been wounded and killed upon making suspected movements toward an alarm control button.

Another serious disadvantage of the manually operated alarm is the involuntary paralysis of the victim in the presence of extreme danger. Even though the opportunity may be afforded, the alarm has failed to come through in many bank robberies, because of the inability of fear-struck victims to function normally.

There is one method, however, that has been widely en-

dorsed by police officials as an effective exciting agent for a robbery-alarm system. Wherever used, it has functioned with great success. Although it is a form of manually operated contact, this device removes the responsibility for setting the alarm circuits in play from the victim and places it upon the shoulders of the bandit. This is accomplished by so placing circuit contacts as to take advantage of the normal physical movements of the bandit in the course of his ordinary movements within the bank. The design and the placing of these contacts make an interesting problem, since there is involved a study of criminal psychology and the modus operandi of robbery in general, in order to select the points where these traps are likely to be disturbed.

Since the object of attack in bank robbery is invariably currency, most of these devices are built into specially designed currency trays, drawers, or other containers for money and other valuables. One instrument now available makes it possible for the employees, while actually carrying out the commands of the bandit, to start an alarm without attracting attention. Important elements in this system, which has a remarkable record of efficiency, include a cleverly concealed button on cash drawers so placed that the cashier can press it when he opens a drawer; also a false bottom so arranged that a slight pressure downward when removing the bills will flash the alarm. Other arrangements provide for carefully concealed springs in currency trays so disposed that the removal of currency therefrom excites the alarm circuit. Such trays usually contain dummy stacks of currency and are placed at a conspicuous spot near the teller's window.

The possible applications of this principle to holdup-alarm installations are almost unlimited.

ALARM-TRANSMISSION LINES

Connecting lines of communication between the exciting mechanism and the alarm terminal or destination usually take the form of direct-wire circuits, and they should be so arranged that there shall be no tampering with them. Such

lines, if available, may be leased from the telephone companies, or they may be installed. Each connecting circuit and its associated equipment, both on the protected premises and at the alarm destination, should be under constant electrical supervision, so that a failure of any part of the system will be automatically indicated. Authorities have estimated that about 20 per cent of the value of an alarm system lies in the apparatus, and that the remaining 80 per cent is a function of expert supervision and care of the equipment. The continued efficient operation of any alarm system is entirely dependent upon this supervision and maintenance.

Transmission of the alarm signal to its destination is not restricted to independent land wires specially installed or leased for alarm-system purposes. There has recently been developed a system—known as the multifold carrier current control system—which may entirely revolutionize the use of land-wire communication facilities. By means of it, the alarm signal may be transmitted to its destination over existing power and telephone lines; and this, of course, would result in a very large reduction in the cost of installation and operation. The arrangement provides for a small and inexpensive vacuum-tube circuit on the protected premises, capable of transmitting frequencies of from 1500 to 3000 cycles. It is only necessary to connect the output of this instrument to the conventional telephone or light socket, thus eliminating the necessity for installation of alarm-system transmission lines. The receiving element at the alarm terminal consists of a tuned circuit and relay, which will respond to the transmitted frequency, and which, again, is connected to the commercial telephone or power lines. In a typical situation a transmitted frequency of say 2500 cycles is superimposed over the 60-cycle lighting current. This 60-cycle frequency has no effect whatsoever upon the received alarm signal, nor do the alarm frequencies interfere in any way with the operation of the power-line service. This absence of mutual interference is also shown where telephone lines are the transmitting medium.

Destination of the alarm may be defined as the point at which an alarm signal makes itself manifest. This is a highly important point, since there seems to be an inherent weakness in this respect in a large number of alarm installations. There are two general types of system and destination: one is the centralized system, in which the alarm signal is silently transmitted direct to police headquarters, or to a police substation, or to a central commercial alarm agency, which sends its own armed riders, and in turn relays the news of the alarm to the police; the other system provides for the sounding of a loud alarm on the premises, either inside or outside, or both, so that everyone in the vicinity may hear it.

The local or loud alarm consists of a loud gong installed on the outside of the place to be protected, usually in front in order to attract the attention of a maximum number of people, and connected to suitable push buttons arranged at convenient points inside. Numerous alarm installations employ this device, which is mounted high enough above the sidewalk to forestall ordinary tampering. Those who advocate the use of the local alarm base their opinions in large part upon its value in the frustration of both burglary and robbery, since experience has brought to light the fact that no burglar or bandit can "stand up" against the sound of a large gong or bell in the immediate vicinity. The desire for a safe escape at any cost becomes irresistible. It is a matter of record that many bank robberies and burglaries have been frustrated through the use of this device.

The local alarm, however, has certain fundamental weaknesses which cannot be overlooked. In large cities, the alarms receive scant attention; the sound does not carry any appreciable distance, and the nearest policeman may be several blocks away when he is needed.

Again, if the burglar sets off a local alarm system, he hears it just as soon as anyone else, and usually can escape without detection. In combating the holdup, local alarms are even less effective. In holdups, criminals work fast, depending a great deal on the fear of the employees. Employees quite naturally

are reluctant to sound an alarm when they are looking into the face of a criminal with a loaded revolver in his hand. Indeed, it may be foolhardy to do so; from nervousness or vindictiveness the intruder will very likely shoot. Still another disadvantage is the inevitable assembling of a crowd, impeding the police and increasing the hazard of injury and death to innocent bystanders. But the disadvantage of the local alarm which commends it to the museum is the fact that although it may frustrate the completion of the crime, it invariably frustrates the efforts of the police to apprehend the criminals. The moment the alarm is sounded, the bandits are on their way to cover; the police have little chance to make the necessary arrests, and as a result there must be long and detailed investigation before the case is finally disposed of, the cost of which falls, of course, upon the community.

The local or outside alarm owes its continued existence to its very low initial cost. It is the cheapest form of alarm installation and it frequently proves in the end to be the most expensive. The underwriting companies regard it as of a very limited value, and some of the large companies do not give any consideration to it or make any allowance for its use.

In the centralized system of alarm control, a silent alarm signal is transmitted to some distant point, remote from the scene of the crime. The terminal signal device may be installed in adjacent or near-by offices or business establishments, from which, when the alarm signal is heard, a message may be telephoned to the police. In other installations, the alarm system is wired direct to the central offices of privately operated alarm-system companies, which maintain motorized armed patrols ready for immediate response to an alarm. Such organizations generally have direct-wire connections with the police department, in order that the police, too, may be promptly notified.

One alarm-system company has 117 central stations and gives a centralized alarm protection service to more than 300 large municipalities in different parts of the United States. Besides burglar- and holdup-alarm service, these organiza-

tions have developed an organized supervision of night watchmen, who are frequently the victims of holdups. If the watchman's activities are supervised by a central station, armed guards are instantly dispatched if the hourly reporting-in signal is delayed. Criminals are often familiar with this fact, and when they raid a factory or building thus protected they may force the watchman to make his regular round of signals. To meet this situation, central station operating companies install on the watchman's route "emergency" stations which look just like the ordinary ones. But the emergency boxes are operated only in the event of a holdup, and a signal from one of them ensures quick action by the guards at the central station and the local police. The intruders have no way of knowing that a call for assistance has been sent.

Many banks and commercial institutions, particularly in the smaller cities, are rapidly adopting the type of installation in which all alarm-transmission lines are wired direct to police headquarters. In respect to police efficiency, this is the most desirable of all the types of alarm installation, and the design of alarm systems will in the future probably follow this pattern.

Up to the present, the advantages of alarm service have been available for only a selected kind of property, and municipal governments have not always felt that, in order to give a specialized service, they could properly use taxes allocated for general police protection. Moreover, city governments are subject to periodic change, and succeeding administrations may well have different policies. All the varying opinions of changing administrations and the lack of continuity in policy and program have, in some measure at least, retarded the development of a centralized police control of alarm systems and have provided the opportunity for the expansion of commercially operated alarm companies. The privately operated companies deal with their clients on a commercial basis, and give an excellent service. The apparatus is kept in perfect condition, staffs of experts are maintained to see that the circuits are properly supervised and operated, and trained per-

sonnel at the central stations respond to the alarms with a minimum of lost time and motion. Nevertheless, this sort of protection is properly a police function in the interest of the whole community, and the responsibility for the pursuit and arrest of the criminal rests upon the police department. In the interest of law enforcement, therefore, the present sharing of this function with a private agency serving a special group in the community must some day give way to a new order, in which the alarm-protection network of the community will become an integral unit in the police communication system.

THE FALSE ALARM

A false alarm is the result of an accidental or deliberate operation of the alarm system without justifiable cause and in the absence of any criminal approach. From the beginning of alarm installations, the false alarm has been a characteristic weakness of all protective systems, and it has come to be accepted as an inescapable evil.

Alarm systems are so designed that breaks, grounds, or crosses between the two sides of the circuit will occasion signals. Despite the use of the best material and the greatest care in installation and supervision, false alarms are bound to occur. The unit of an electrical alarm system, such as lacing-wire, and wire used in screens and wall protection, must be of small gauge, so that it cannot be handled without breaking; otherwise, wires might be spread or otherwise manipulated so as to afford entrance to protected premises. The only effective method of protecting show-window glass is to paste foil on its surface, and the gauge of this foil must be such that it will rupture when the glass is broken.

All this delicate wiring is exposed to accidental trouble. Window washers and workmen making repairs about the premises may accidentally rupture the alarm circuit. Water leaking from pipes or blowing in from rainstorms may cause short circuits. Even rats and mice have been known to occasion alarms. Corroded contacts, defective insulation, inefficient or defective relays, weak or broken springs, trans-

mission-line trouble, short circuits, alarm-terminal defects, and numerous other circuit factors may operate to cause a false alarm. Yet this hazard may be minimized, if not completely eliminated, by the selection right at the start of an alarm system manufactured by a reputable and responsible company, and expertly installed, supervised, and maintained.

Carelessness of employees in protected banks and other institutions causes a large number of false alarms. Proper instruction and educational work will do much to eliminate this hazard. It not infrequently happens that all the employees are not properly informed about the system of protection provided. The author, with several other officers, once responded to a false bank alarm which affords an interesting commentary. Of five bank tellers and clerks, only two knew the locations of all the alarm contact buttons. Besides the hazard which this implied in the event of a robbery, there was also the likelihood of a larger number of accidental contacts.

Some authorities advocate imposing a penalty upon the person responsible for this sort of false alarm. In view of the risk and hazard that is connected with the response to an alarm, this proposal does not appear so radical when all aspects of the question are weighed. The imposition of a small penalty by the personnel officer of the institution concerned would undoubtedly help to eliminate the evil.

A certain police department had been annoyed by the frequent arrival of false alarms. These became so numerous that, as a temporary respite from the unnecessary dispatching of the armed guards, the desk sergeant adopted the practice of telephoning the institution in which the alarm originated as a means of reducing the number of interruptions to patrol activity. Usually, this meant only the recording of another false alarm. But on one occasion a bank robber answered the telephone, and in response to the desk sergeant's inquiry, "Everything O. K.?" replied, "Everything O. K." In this happy state of freedom from further molestation the criminal completed his robbery in a leisurely manner with a safe escape from the premises assured.

It is an unwritten police law that an incoming alarm is to be considered genuine and summary action taken, until the contrary fact is known. The discipline and practice gained by answering false alarms may be of great value in the formulation of tactical patrol plans of operation. The drill will indicate to commanding officers weak points in the scheme of emergency-patrol operation and point the way to improvement—a revision of dispatching procedure, perhaps, or of the routes of patrol concentration, covering plans, and other important aspects of emergency work. An alert organization may develop from this erstwhile annoyance much useful strategy.

Repeated false alarms may also result, however, in a "let-down" in morale or in what may be termed "fighting interest." In this respect the false alarm is a dangerous affair. The suspicion that the alarm is probably false makes for relaxed vigilance and a dissipation of alertness and other qualities essential in facing a potential emergency. Then, too, it is to be remembered that an alarm response involves a rapid concentration of patrol units closing in on the location at speeds far above the average for city thoroughfares, with attendant hazards to life and property. False alarms cause a needless exposure to these risks. The objections to false alarms are far greater, of course, both in respect to public interests and the efficiency of the police department, than any value that these alarms may have as a school of instruction.

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Underwriters' Laboratories, Inc., chartered by the state of Illinois in November, 1901, is authorized to establish and maintain laboratories for the examination and testing of de-

vices, systems, and materials for the purpose of reporting thereon to insurance organizations. The corporation was established and is maintained by the National Board of Fire Underwriters for service, not for profit.

The insurance interests which pay the burglary and holdup losses are keenly interested in alarm systems. Field underwriters, not being experts in electrical equipment, proved unable to determine whether or not an alarm system installed on a risk was of sufficient value to merit recognition in the form of reduced premiums. In 1925, the National Bureau of Casualty Underwriters requested the Underwriters' Laboratories to set up standards for, examine, and pass upon burglar and holdup alarm systems for which the owners wanted recognition in the amount of the insurance premium. Under this arrangement, a company proposing to install an alarm system must take the devices to the Laboratories, and these devices must pass certain tests and requirements before the recognition is granted. In the awarding of a contract for an alarm installation, therefore, a comparison of the relative merits of the various systems as reported by the Underwriters' Laboratories should be the decisive factor. Some systems just barely "get under the wire," so far as the corporation is concerned, and others give protection far in excess of its standards.

The object of Underwriters' Laboratories is to determine by reasonable, practical, and independent investigation, the relation of devices, systems, and materials to life, fire, and collision hazards, and to theft and accident prevention. During the past ten years this work, undertaken as one means of reducing the enormous and disproportionate loss of life and property by fire, theft, and accident, has done much to improve the electrical design, electrical supervision, tamperproof qualities, and maintenance of alarm systems. Besides separating alarm systems in respect to types, the corporation further classifies them in respect to grade or merit, Grade A being the highest classification. Individual installations may vary still further in respect to extent or completeness.

The comprehensive testing equipment of the Laboratories in the hands of its staff and of experienced engineers affords exceptional facilities for the work that the corporation has undertaken. Its long experience and the methods used for keeping in close touch with manufacturers, users, inspection bureaus, and other sources of practical information have secured a wide acceptance of its standards and recommendations. The great potential value to banks and similar institutions of its accumulation of sound research data will only be realized, however, as the pressure of insurance companies and public opinion creates a demand for safeguards against robbery and burglary that are designed to meet the numerous, individual hazards.

Annual lists of devices approved by the Underwriters' Laboratories are widely distributed, also semiannual supplementary lists of the manufacturers whose devices are listed. The devices are subject to appropriate inspection by the corporation's inspectors and engineers. It is the consensus among police officers that no alarm equipment should be purchased that has not been approved by the Laboratories.

Comment should be made, however, upon the approval and recognition by the Underwriters' Laboratories of the outside gong or local alarm installation on the premises—a logical result of the close relationship existing between the testing agency and the insurance companies. With respect to the insurance risk, *frustration* of a burglary or robbery constitutes protection since loss of the insured property has been prevented. Law enforcement requires, in addition, *apprehension* of the lawbreaker. Mere frustration of a crime does not solve the larger problem of reducing the potential crime total of a community, which continues as a direct threat to insured risks of all kinds. Elimination of the opportunity to commit crime must be supplemented by treatment of the desire to attack. Certainty of arrest and speedy disposition of cases in the trial court are important elements in any broad program of crime prevention and detection. This broader view must eventually lead to a combination of the two interests, and to

the concentration of alarm-communication facilities in the police department as the law-enforcing agency of society.

Insurance companies give substantial discounts on premiums for burglar-alarm systems of both the local and the centralized types that have been installed on bank vaults, and for some classes of systems installed on mercantile premises, depending, of course, in all installations, upon the completeness of the wiring. The certificate of the Underwriters' Laboratories appears on between fifteen and twenty thousand alarm installations in various sections of the country. This in itself would seem to indicate that it is either necessary or profitable for the merchant or bank to install some form of alarm protection.

Obviously, the economic saving effected through the installation of an efficient alarm system depends somewhat upon the size of the risk, or its value in dollars and cents, if we eliminate from the equation altogether the value of life. It is generally considered in insurance circles and among those who have benefited through alarm installations over a long period of time, that the saving on insurance premiums alone is sufficient to pay for the maintenance of the protection and give a return of 6 per cent on the investment therein, with amortization of the entire cost of the equipment over a comparatively short period of years. With continuing improvement in alarm-system equipment and technique, this economic return will become greater.

Robbery protection is a newer development, in which, also, the human element and ingenuity of the robber plays a larger part. Underwriting companies have not thus far been inclined to give as substantial recognition to robbery-alarm systems as to burglary-protection equipment. Premium rates for insurance against robbery are a simple but illuminating story, and a fair index as well to the changing trend in bank robbery.

Nine years ago the night burglary hazard in banking was so much greater than the daylight robbery hazard that insurance premiums for robbery risk ranged from one-fourth to one-half of the burglary rate. Until 1918, the holdup coverage

was "thrown in" with the burglary and robbery policies for good measure. Today the reverse is true, and in some states the gap between premiums on the two risks has steadily widened. Authentic reports show an increase in bank robberies from 143 losses in 1921 to 292 losses in 1928 and 402 losses in 1930; interior or store robbery losses mounted from 550 claims in 1921 to approximately 3000 in 1927. Stated in another way, there is about one holdup each hour in every day that commercial institutions are open for business.

It is significant that one of every three bank burglaries attempted in the past two years has been frustrated; or at least the loss has been from damage done, and not in money or securities. If experience means anything, science and invention have caught up with the burglar, and many bankers in making their selection of the protective devices thus made available have shown at least the same care that the burglar shows in his preparation for the attack. This is not true in respect to the banker's defensive measures against daylight holdups directed against undermanned or unguarded banks. In contrast with the banker's efforts in foiling one out of every three burglary attempts, he fares considerably worse against the robber: the records show that only one holdup is frustrated out of every seven attacks. Moreover, the average haul in a bank holdup is much greater than in a burglary.

BANK ROBBERIES: HISTORICAL NOTE AND CONTRAST

Two of the earliest recorded bank robberies in Iowa were the work of two gangs apparently independent of each other. About six months later, a succession of bank burglaries began throughout the state. As these crimes were run down, the perpetrators were found to be typical of the old-time bank burglar, whose custom it was to loaf on his takings.

All the members of both organizations were sent to prison. Later, with the assistance of friends on the outside, the members of one gang shot their way out of jail, killing the sheriff's son, but they were captured and sent to prison for life.

Just a little later the Federal government, coöperating

with the St. Louis Police Department, rounded up and sent to the penitentiary some twenty-eight members of the Colbeck, Cuckoo, and Egan gangs, thereby bringing to a close a long and desperate series of bank robberies. Still later, there was encountered in Illinois a gang of between fifty and a hundred bank burglars and robbers, who were more or less of the

SYNDICATED BANK ROBBERIES FROM DECEMBER 1, 1925, TO DECEMBER 1, 1932, IN SEVEN MIDWESTERN STATES*

State	Number of robberies	Number of bandits participating	Number convicted	Number bandits killed	Loss	Citizens or officers killed	Amount recovered
Indiana	4	20	0	0	$ 398,245	0	0
Illinois	1	6	1	0	23,500	Cashier killed; officer wounded	0
Iowa	6	37	0	0	244,022	0	0
Michigan	4	20	0	0	358,000	0	$ 90,000
Nebraska	2	9	2	0	2,305,000	0	583,000
Ohio	4	20	3	1	584,000	1	75,000
Wisconsin	6	28	2	0	1,293,700	0	319,000
Total 7 states	27	140	8	1	$5,206,467	2	$1,067,000

* Source: *Journal of Criminal Law and Criminology*, Vol. 23 (1933), p. 799.

old school. This almost unheard-of organization of so many thieves with wide criminal experience did not bear any earmarks of a national organization, as their activities were mostly confined to the state of Illinois. These men engaged in what is termed "independent bank robbery." The losses sustained by their activities were heavy, but they pale into insignificance when compared with the amount of loot obtained by bank-robbery syndicates (see the accompanying table).

By the year 1925, the police realized that each year a few bank robberies were taking place in the middle western states, with losses generally running at from $100,000 to $500,000. Furthermore, in each of these robberies, it was evident that the premises had been well surveyed and that the holdup had

been committed by men of a different type from the participants in independent bank robbery. These bank robbers constituted in fact a syndicate, and were rarely apprehended.

The participants in syndicated bank robbery are an older, more vicious type of person and as a rule they have long criminal records. They spare no expense in equipping themselves with every possible weapon of defense, including machine guns, tear gas, automobile smoke screens, and other devices. They are strongly intrenched politically, and usually have very definite protective arrangements with some high officials in the city from which they operate. They retain corrupt criminal attorneys and maintain a large sinking fund for the defense of any of their members who may get into trouble. If one of the organization is arrested in any city on the North American continent, the best criminal attorneys in the city appear, as if by magic, to defend them. This policy, together with their powerful political connections, often makes extradition impossible.

Despite this challenge, up to the present time only a small percentage of banks have taken advantage of the protection afforded by the alarm installation. The number is so small, indeed, that it makes but little impression on the bank-robbery problem, with the result that insurance premiums against robbery attack in many places have reached extravagant levels. Bank managements are beginning to realize, however, that it is just as necessary to seek the services of a protective-equipment engineer as it is to consult an architect, record-system expert, or the agent of any other specialized service in connection with bank operation.

Next to banks, jewelry stores present the greatest hazard so far as robbery and burglary are concerned. When the Jewelers' Security Alliance was organized fifty years ago, the only method used by criminals in stealing jewelry was safe burglary. For about twenty-five years the Alliance limited its service to the combatting of that crime, and it almost succeeded in driving safe burglars out of business so far as jewelry stores were concerned.

The criminals who formerly robbed safes, however, developed other plans for attacking jewelers, and the crimes of window-smashing, sneak theft, holdup, and burglary, without attack upon the safe, began to be so numerous that the jewelers were obliged to take note of them in their plans of protection. The larger part of the work of this Alliance at the present time is concerned with the crimes of holdups and sneak theft.

The accompanying table (p. 295) throws considerable light upon the crime problem from the jewelers' viewpoint and indicates the opportunities that exist in this field of engineering protection.

To the losses sustained by banks and jewelry stores must be added the enormous total of money and property obtained through the burglary and holdup of mercantile establishments in general. Information travels rapidly in the underworld and attacks are generally made where safeguards are known to be inadequate. Since the most expert attacks are directed against the greatest hazards, banking institutions, jewelry establishments, pay offices, and other places where large quantities of valuables are kept, should be equipped with the best and most complete forms of protection available. The average criminal possesses too keen a sense of prison humor to risk detection and arrest by attacking premises which are known to be protected. If, in ignorance of the true situation, he makes such an attack, the rapid arrival of an armed patrol force soon brings him to an inglorious end.

Besides theft, there are two other hazards against which the alarm system may provide a full measure of protection. In both fire and riot, money or valuables may be subject to destruction or confiscation; in such contingencies, the alarm system is in a preferred position to summon assistance in the shortest possible time.

The advent of radio communication in modern patrol service has added to the potential value of the alarm system and will prove very helpful in the centralization of alarm-communication facilities at police headquarters. Where, as with

ATTACKS UPON JEWELERS

Year	Number	Safes	Number	Stores	Number	Windows	Number	Sneaks	Number	Holdup and assault	Totals	
											Number	Amount
1921	43	$ 225,466	228	$282,190	344	$187,794	225	$166,097	133	$ 979,118	973	$1,840,575
1922	35	245,900	217	128,600	234	159,700	150	115,500	141	824,000	777	1,473,700
1923	48	450,000	207	175,000	293	300,000	195	250,000	117	800,000	860	1,975,000
1924	55	480,400	273	461,600	308	179,800	162	138,600	202	2,123,000	1000	3,383,400
1925	30	189,495	189	339,190	295	162,240	152	152,868	205	2,304,965	871	3,148,758
1926	40	459,206	173	208,274	320	256,588	145	155,738	99	559,284	777	1,639,090
1927	33	1,212,326	127	231,447	243	146,930	135	155,945	100	576,325	638	2,322,973
1928	23	236,600	154	194,143	258	150,593	185	132,851	91	883,749	711	1,597,936
1929	30	183,520	142	142,887	253	137,895	156	271,693	77	517,579	658	1,253,574
1930	24	351,312	121	172,052	277	199,830	217	231,215	143	1,419,507	782	2,373,916
1931	18	400,959	92	140,060	212	178,080	122	67,778	96	1,497,105	540	2,283,982
1932	18	208,811	52	123,828	200	80,619	86	57,710	97	1,016,276	453	1,487,244

the alarm circuit, the request for assistance is synchronized with the attack, operating-time intervals undergo a drastic reduction, and, when supplemented by radio broadcast, it becomes possible to officers to be at the scene of the crime in ample time to take the most effective action. That the future design and installation of alarm systems may be largely influenced by these considerations is evidenced by a number of developments in this field which point toward a more complete utilization of the possibilities offered by radio communication. For example, police experts and radio engineers have been giving attention to the development of automatic radio-alarm systems which shall be most direct in their operating sequence. In one such system, the contact or exciting device sets in operation a phonographic pickup apparatus at the bank, which is wired direct to the speech-input system of the police transmitter. The procedure at this point is similar to the use of electrical transcriptions by commercial broadcasting stations. The recorded wording on the transmitting record consists of a brief message announcing trouble at a given bank or other location, in code or otherwise. This message is repeated continuously until the alarm is manually shut down. Circuit arrangements in the system are such that, when the alarm goes into play, all other lines to the transmitter are automatically cleared, giving the alarm boadcast priority over all other police traffic.

In this arrangement there is a decentralization of patrol control in which, for the moment, all detours are eliminated and communication is direct between the victim or premises attacked and the radio-equipped mobile patrol force. Although the alarm passes through the transmitting equipment at headquarters, the radio dispatcher is immediately eliminated from the scheme of operation and the effect is the same as if the victim or premises were equipped with an individual transmitter. Patrol cars equipped for two-way communication on arrival at the scene of action may instantly convert the entire patrol force into one powerful unit to form a cordon in the vicinity, blockade exits, or take whatever action is

required. Yet this is merely an introduction to the potentialities of electrical protection, and but faint indication of the rôle to be played by alarm and communication systems in the police service of tomorrow.

Chapter IX

COÖRDINATION OF THE POLICE COMMUNICATION SYSTEM

THE POLICE COMMUNICATION SYSTEM comprises a series of closely interlocking operations, each function dependent upon and contributory to the others, the whole coördinated into a systematized plan. The primary purpose of the system is reduction of delay, whether between the commission of a crime and the apprehension of the law-breaker or between the occurrence of the emergency and the required police action. Toward this end, proper provision should be made in the rules and regulations of the police department for the orderly and uniform use of all the available facilities that are essential to this purpose. The operation of the switchboard, use of the recall and beat telephone systems, and all the other functions of the various communication units should be the subjects of concise orders from the Chief's office. Only by such definite and comprehensive instructions can the separated units be brought together in the necessary coöperation. Furthermore, since the communication system is an integral part of that larger organization, the police department, the men responsible for its administration must take cognizance of the relationships of the communication system to other branches of the department. Some of these relationships it will be well to consider in detail.

LINE DECENTRALIZATION

In modern police administration, in England and America, there has gradually been accepted the far-reaching principle: Decentralize wherever you can, centralize only when you must. In decentralization a large city is subdivided into police divisions, and these into police precincts; the precincts are in turn divided ultimately into the fundamental unit of police operations, the police beat, to which a patrol officer is assigned. Various considerations govern the determination of the size of these subdivisions. No division or precinct should

be so large that the commanding officer will find it difficult to maintain discipline and morale and fix responsibility among his police officers. He should have full knowledge of the criminals and potential offenders living in the area and should also establish friendly relations with the respectable and law-abiding members of the community. No fixed rule can be laid down, but a population of 50,000 is usually considered the maximum for the station commander who would give the police protection and service that is needed.[1]

Decentralization would be impossible without some means of communication between a station and its force distributed on the beats. Yet centralization of all the police strength at a central headquarters would obviously be hazardous and impracticable. The communication system acts here as a means of control that makes possible the distribution of police strength throughout an area. Two divergent opinions appear at this point. There are those who think that the communication system should be completely decentralized, with a certain measure of control over their respective areas delegated to the substation commanding officers; and there are those who think that all control should be centralized and all lines of communication converge at central headquarters.

THE CENTRALIZED POLICE-COMMUNICATION SYSTEM

In the centralized police-communication system there is a complete concentration of all authority, all control, and all functions in one central administration, the Central Communication Bureau, which is usually at central headquarters. This concentration implies a complete unification of the communication system as opposed to a comparatively loose assemblage of quasi-independent parts. The control of all lines of communication—visible and audible signal recall systems, beat telephone systems, telephone, teletype, radio, and incoming reports and complaints—are completely centralized at police headquarters. Communication out of precinct stations

[1] See *Report of the National Commission on Law Observance and Enforcement* (1931).

is limited to telephone and teletype contact with headquarters, and the control of beat patrol forces is centralized at the one control point.

The ultimate test of a communication system is the emergency, and the measure of its efficiency is the speed with which police strength may be concentrated in a given quarter. In emergencies, the centralized or highly unified communication network relays the alarm to the points of control with no loss of time. Lines of communication are direct. Orders and information may be transmited to every corner of the city with dispatch, and mobilization of the patrol strength becomes a comparatively simple matter. The instructions are given intelligently, the officer having in mind the proximity of particular units of the patrol force to the place of action and to the strategic points to be covered, and possessing also a good general knowledge of the man power and equipment available and its disposition throughout the entire area. Furthermore, because of the wide perspective of operation, the officer in the centralized bureau can supervise the movements of this scattered force, in whole or in part, to the best advantage.

Centralization of all facilities in one office is economical because it makes unnecessary much of the duplication of personnel, labor, equipment, and appliances. The peak traffic loads of the districts counterbalance one another in a central office, bringing about an automatic adjustment of communication traffic and thus doing away with excess personnel. Officers can easily be shifted to points where there is a pressure of work, supervision and inspection can be more easily done and at less cost, and uniformity in technique and operation are more easily secured.

Centralization almost invariably develops specialization, for which there is great need in modern communication technique. In the small, decentralized substation bureau, the officers must perform all the communication functions, and they have little opportunity for specialization; a large force of men almost instinctively breaks up into specialized groups. In thus specializing, however, these men have the background

of the wider and more extensive experience obtainable in a large and comprehensive communication bureau. They come to appreciate the general police communication plan in terms of a city-wide crime-fighting organization. Their entire attention is directed toward this one purpose of conquering crime. They have the facilities wherewith to make practical tests of every new improvement as it appears, and they are constantly studying to make their own contributions to the solution of the problem of crime. These are the dividends of specialization.

CENTRALIZATION AND RECORDS

Every police force maintains some sort of record of the offenses that come to its attention, of the action taken, and of the persons apprehended and their disposition, together with a wide variety of other facts that have to do with departmental duties and functions. These records may be divided into two general categories: first, those that are routine, for example, a patrolman's report on the condition of a broken sewer-cover with a notation of the action taken; and second, and far more important, those reports pertaining to crime and criminals and other subjects which have a definite bearing upon police administrative policy. Current information, for example, concerning the number, place of occurrence, type, and time of known offenses is correlated with distribution of the patrol force, plain-clothes investigators, and crime-prevention officers according to police district, post, month, day, and hour. In these reports there are also accumulated descriptions of persons and property, and accurate statistics on the amount of crime within respective areas—indispensable data in the detection, apprehension, and identification of offenders. These various data concerning crime will often be suggestive of studies that may lead to better handling of situations and to a reduction of crime in the areas studied. Honestly and accurately recorded from day to day, and summarized in monthly and yearly reports, they are invaluable as a basis for departmental reorganization, administrative strategy, and long-range crime prevention.

So far as centralization or decentralization of the police record division is concerned, the advantages lie with centralization. That all information should be concentrated in one place and thus be easily, quickly, and completely available is indeed almost imperative in modern police administration. The centralized record system will be found in many modern police departments. There the necessarily separate parts of a record can be coördinated, and the responsibility for the work be placed upon a single subordinate executive.

The correlation of function and close coöperation that is essential between all parts of the modern police department is particularly needed between the communication bureau and the record division. By far the greater part of the complaints, reports, and information received by the police department comes over the lines of communication. A comparatively small percentage of these may be delivered personally at the complaint desk, but this desk is essentially a unit in the communication system. The communication bureau is thus the first, although a temporary, custodian of information in any form that it may take, and as such is directly responsible to the record division for its accuracy, safekeeping, and certainty of transfer to the commanding officer of that division. Theoretically, and it so works out in practice, the record division delegates this authority for temporary custody of records to the communication bureau. Advocates of the centralized communication system therefore believe—and rightly—that the record division should have a supervising control over communication. They also point out that, in the centralization of communication facilities, if one single control point were located in the functional area of record operations, the record division would immediately secure such control.

The reception of reports and complaints involves the assignment of officers for their investigation and disposition. In modern police administration, these assignments are simultaneous with the reception of the report and they are almost invariably transmitted over communication lines to the officers whose beats they concern. Decidedly, the record divi-

sion is interested in these assignments. It is concerned not only with the certainty of receiving an accurate copy of the original report, but also with the prompt filing of reports by the investigating officer and a final disposition of all the records in a case as soon as possible.

In self-defense, if for no other reason, the division must possess a supervising control over all agencies in the organization that have to do with record procedure. It is therefore a logical opinion that communication facilities and activities should be centralized, with the focal point of control under the watchful eye of the record division.

A centralized communication system makes possible the collection of uniform and accurate records; it also eliminates the possibility of collusion between substation commanding officers and the men out on patrol. If the report or complaint must come through the central office for assignment of action thereon, it is quite likely that the record will be as nearly accurate as it is possible for records to be.

A decentralized system of communication, on the contrary, may easily result in the corruption of a police record system and reduce, if not destroy, its efficiency. In an impartial survey of the Chicago Police Department in 1931, by the Citizens' Police Committee, the separation of the communication system from the record division was definitely condemned, and comment was made as follows:

> Available means of communication and records must of necessity be closely articulated. A centralized system of crime records requires a centralized system of communications in order that citizens' complaints and the reports of police officers may be promptly placed under official control and assignments for investigations judiciously effected.
>
> The Illinois Bell Telephone Company provides a means of communication from the general public through both the listed subscribers' numbers and the general police emergency type of communication. Thus, a citizen's emergency call might be connected with any of the several police districts in the telephone exchange area from which the call originated. This condition sometimes caused considerable delay in relaying the call to the proper district and prevented prompt action by the department in meeting an emergency.
>
> Decentralized handling of criminal complaints also rendered accurate

crime accountings extremely difficult. Both have been remedied by the installation of a central complaint room switchboard, where city-wide calls for police assistance are now directly connected and promptly distributed.[2]

In a projected plan of departmental reorganization, incorporated as a part of this survey, these two administrative units were therefore brought together under a single command. Accordingly, it was recommended that the teletype transmitters, which had been at some distance from the record division, should be installed in a room adjoining the central complaint room, thus greatly expediting and improving the service. All other means of communication employed by the police were to be centralized, making possible a central clearinghouse for all citizens' complaints, which in turn determines the method to be used in communicating them to the various police units directly concerned.

The centralized communication system has certain practical limitations, however, which become evident as the department grows in size and the volume of business increases. Too great a degree of centralization may produce a clumsy, unmanageable machine, since the larger the force, the greater the opportunity for delay. The disadvantages of a completely centralized police communication system are in large part the advantages of decentralization.

THE DECENTRALIZED POLICE-COMMUNICATION SYSTEM

In a decentralized organization, the various units are permitted to operate with as little interference from the central authority as is compatible with good service: administrative powers and functions are transformed from a higher to a lower authority. In a decentralized police communication system, reports and complaints are received at substations and are assigned from that point to beat officers in the individual area controlled by the substation. It must naturally follow that to the individual station is delegated the control of communication equipment used between the station and the

[2] Citizens' Police Committee, *Survey of the Chicago Police Department* (1931).

beats, in order to expedite the operation of the decentralized patrol force.

Decentralization, of course, has its limits: complete decentralization would simply be a collapse of the whole police organization. Decentralization implies, rather, that any decision should be made at the lowest point in the organization at which the person deciding possesses all the facts necessary for a sound decision. In other words, decentralization is not properly a matter of delegation but of function; the man who possesses the facts should be the man to decide. If we begin with a rigid headquarters control and an organization strongly centralized, it would, despite the form of control, work toward decentralization through the gradual adoption of local areas of activity.

Decentralization in line organization, as has been indicated, is a generally accepted principle in police service. To centralize highly the communication system is to negative to a great degree the advantages obtained through modern line decentralization. Such decentralization is attainable only through the facilities of communication, and if the administrative pattern of the communication system is the converse of the patrol plan, it will be realized at once that two widely divergent principles of organization are in serious conflict. Such a paradoxical arrangement may even undermine a department's control of its patrol force.

Excessive centralization of decision wastes the resources of the organization. In all departments there is an abundance of ability to handle routine matters. By localizing the responsibility for local decisions, the interest and initiative of subordinate commanding officers and the men they control are increased. The commanding officer is in direct control of the men in his area and their responsibility to him is clearly defined. This localization of control and responsibility deepens the interest and loyalty of the men, with the result that the neighborhood benefits in the quality of its police protection.

Police service has undergone a tremendous change in the last two decades. With the coming of the automobile, rapid

means of communication, and the expanding application of the social sciences, the policeman is no longer merely a punitive agent of the government; in the greater project of crime prevention he has responsibilities for the social welfare far beyond those of any other person in the community. He is likely to be the only representative of the government that the newcomer in town knows. His desire to prevent crime may lead him to activities seemingly remote from his proper sphere. For example, one officer fostered the construction of playgrounds in his district, organized competitive sports, and found other means of providing good outlets for the leisure-time energies and activities of youngsters. The interest and initiative that led to this constructive activity are a result of the decentralized plan in which responsibility for the care of an individual administrative area is placed upon one commanding officer, who in turn shares this responsibility among the men on the beat. Where this responsibility is taken from the commanding officer, as it is in a highly centralized organization, interest and morale decline, since there is little incentive toward those extra activities which distinguish modern police service from the service of a decade ago.

Further, in the decentralized arrangement, precinct officers, being conversant with the characteristics of the area under their jurisdiction, may control the patrol force to better advantage than is done in a centralized system in which all control and orders emanate from a central headquarters. Many crimes are local, requiring a special and detailed knowledge of neighborhoods and their people. Certain classes of criminals tend to operate in restricted localities rather than over an entire city. The communication system is intimately interwoven with the local aspect of the crime problem and the plan for movement of the patrol force.

The precinct commanding officer gains an intimate knowledge of the people who reside in his area. He is thus in a position to become thoroughly acquainted with the crime, vice, and traffic conditions within the district assigned to him for protection. Moreover, responsibility can be fixed only where

the territory or police problem is decentralized to a point where a single subordinate commanding officer can grasp the situation. Because of the certainty and intelligence connected with this form of control, discipline is encouraged, and the police campaign against crime and corruption within a given district is strengthened.

DECENTRALIZATION AND THE RECORD DIVISION

How about the record administration under a decentralized system? The answer to this question is difficult, and yet it would seem fundamental to success that reports should be received in the first instance by the station which is expected to give attention to them. Since the report is received in its original form, the opportunity for error in transmission is reduced, and no time is lost in dispatching assistance.

It is true that the position and functions of the record division must be correlated with other branches of police activity, particularly communication. But if, in establishing this correlation through a centralized communication system, we paralyze the efficiency of the patrol force, the plan must be abandoned. In the last analysis, the record division is dependent upon the patrol force for the material without which it could not function. Furthermore, the physical delivery of police protection is a patrol responsibility—and this is the ultimate objective of the entire department.

The record division is one of the tools or instruments employed, but it is the patrol force that acts. According to advocates of the decentralized plan, the requirements of patrol service are primary, and all other considerations are secondary. The integrity and correctness of the reports can be tested from time to time by a system of inspection, as all other police activities are, and if any falsification of records is found, the offender may be dismissed or demoted. No mechanical scheme, whether centralized or decentralized, can ever ensure absolutely correct records; that depends upon the personnel, and no administrative mechanism can overcome a weakness in personnel.

In some cities, notably Los Angeles, record routine has been adapted to the decentralized plan in such manner as to achieve an effective control over the recording of police action in response to a complaint. When a complaint is received by the precinct station, for example, assistance is immediately dispatched, either through the station or through the communication division. At the same time, the record division at Central Headquarters is asked to give the precinct station a number to apply to the complaint. At this time, also, headquarters is told of the complaint. The allotted number automatically becomes a charge against the precinct station until the record division is in possession of complete information and records on the case, as well as a report of its final disposition. Obviously, this arrangement affords the record division a very satisfactory supervision over record procedure.

The territorial distribution of communication facilities is unavoidable. The physical distribution of equipment in large cities is so immense that centralized control is impracticable. The volume of transactions may become too great for one bureau to handle efficiently. Decentralization both relieves the central authority and utilizes the greater familiarity of the subordinate officers with local conditions, to the more effective exercise of the agencies of control. Adequate safeguards must always be present, however, to counterbalance the resulting hazards of comparative isolation. Excessive decentralization means a scattering of strength, and sometimes a jealous lack of coöperation with consequent dissipation of departmental effectiveness. Faulty control may easily permit of collusion between precinct commanders and beat officers, resulting in suppression or falsifying of records and their uselessness except as evidence against the officers involved.

COMBINATION METHOD OF CONTROL

In actual practice, organization experts have come to agree that both centralization and decentralization have their advantages and their defects, and that neither complete cen-

tralization nor complete decentralization is desirable. Each system must borrow from the other until an organizational equilibrium is established, the proportions of the combination depending upon the purposes of the organization and the conditions under which it must carry out those purposes.

In Berkeley, Calif., for example, population,[3] area, and other factors have not required a territorial decentralization into police precincts. There is one police station; all lines of control radiate from that point, and so do the lines of communication. Normally, there is no necessity for any intermediary form of control between headquarters and the beat. In extreme emergencies, patrol officers in cars equipped for two-way radio communication that happen to be at the scene of action may relieve headquarters of the control function for the duration of the emergency.[4] This novel and effective form of decentralization is a collateral development of two-way radio communication and is now being adopted by many police departments. Fundamentally, however, the communication system in Berkeley is spread out upon a centralized pattern.

The complaint desk, joint auxiliary of the communication and the record systems, is centrally placed at headquarters, where it is easily accessible to the public, to members of the record division, and to other staff members of the department. The telephone exchange board is placed opposite the complaint desk and in the same room. All incoming calls of whatever origin or kind are received at this exchange—a complete centralization in this one respect. The exchange board accommodates direct lines to the offices of all departmental staff members. Intercommunication lines similarly connect the exchange board by direct wire with other municipal offices, including the fire department. Direct telephone facilities are also maintained between this exchange and the central offices of near-by police departments.

Approximately ninety police-box telephones are distrib-

[3] Population, 86,000; area, approximately 10 square miles.

[4] See page 318.

uted at strategic points over police beats in all sections of the city, all of which feed directly into the telephone exchange board. Through the distribution of red-light signals throughout the city, it is possible to recall any individual officer, any group of officers, or all officers simultaneously. Geographical selection is further provided by means of signals that may be flashed in a particular section or beat. The recall control mechanism is in the same room with the exchange board and is adjacent thereto, so as to be conveniently available for rapid operation by the exchange-board operator.

The radio microphone is directly in front of the telephone operator, with remote-control equipment of the transmitter within easy reach. Furthermore, the lines of all the bank and burglar alarms that are installed in Berkeley are routed directly to the exchange board. Sending and receiving teletype machines, which connect the communication bureau with outside departments and with the state-wide and Pacific Coast networks, are installed in the same room. On top of a twenty-one-story office building in the city is a powerful siren which may be operated by remote control—a button conveniently near to the operator. This signal is designed for city-wide alarms, such as disaster, catastrophe, or other grave situations.

Here is presented a compact laboratory of communication facilities and an excellent example of the centralized system. All lines of communication focus at one point, thus centralizing the control of a decentralized patrol force. Mobilization of the patrol force is rapid in emergencies, and the criminal finds that his operations in the city of Berkeley are attended with more than ordinary hazards.

The centralized communication system is a natural installation in the comparatively small city in which all lines of control may be concentrated at one point. It is where population, area, and other factors force a territorial decentralization of a city into administrative areas and the establishment of precinct stations that communication planning becomes a real problem. The necessity for an intermediary form of

control—the precinct station—between headquarters and the beat increases the complexity of the situation.

Let us enlarge our consideration of the Berkeley communication system, and assume that this city is only a suburb or precinct in a greater metropolitan area. This is a not unlikely situation at some future time, since Berkeley is one of twenty or more closely adjacent communities lying along the shores of San Francisco Bay. Separated mostly by imaginary and meaningless political boundary lines, the cities of San Francisco, South San Francisco, Oakland, Berkeley, Alameda, Hayward, San Leandro, Emeryville, Albany, Piedmont, El Cerrito, Richmond, and others, practically constitute one great metropolitan area. The densely populated residential sections of one community merge into those of an adjacent city so completely that the unsuspecting motorist finds himself violating a half-dozen traffic codes in as many different cities within a short interval of fifteen or twenty minutes. The combined population and area of this entire district would of course dictate a thoroughgoing plan of territorial decentralization. Assuming, for purposes of discussion, that San Francisco was chosen as central headquarters, what plan of communication would serve effectively such a gigantic organization? Obviously, a coalition of the centralized and decentralized forms of control must be devised.

At central headquarters would be the record division covering the entire area. Development of the necessary record forms, technique, and procedure would be a comparatively simple task. Appropriate inspection and investigation of personnel would disclose any irregularities in records and suggest the means for their elimination. By such administrative expedients it would be possible to give the record division the assurance, to which it is entitled, that the established standard of record procedure is being maintained. Through consolidated daily sheets, monthly, annual, and special reports submitted by the commanding officers of the various administrative areas, the central headquarters would be kept constantly informed concerning the state of affairs in these

districts. From the accumulated information on file at headquarters, the statistical staff might make studies and prepare statistical analyses showing the problems of crime that were encountered and the effectiveness of the police in solving them. Thus, through the aid of a highly centralized record division, administrators would be enabled intelligently to formulate policies for the efficient administration of the metropolitan department.

With respect to the communication system, conditions would be entirely different from the highly centralized situation described for Berkeley as an independent municipality. There would be a huge metropolitan police area in which the police line organization was decentralized into twenty or more police divisions, each in turn decentralized into precincts, and these again, into police beats. A commanding officer would be in charge of each precinct, and his responsibility for policing his precinct would be analogous to that of the chief of police of an ordinary community.

Control in such an organization must be a decentralized function, but the unity of the organization remains; and the phenomenon which preserves the organization intact is the reverse flow of responsibility over these same lines of control. According to the theorem of communication, namely, that the lines of communication must always parallel those of administrative control, wherever control is decentralized, at that point the lines of communication must also be decentralized, and wherever a central point of control is set up, there also should be set up a central control of communication.

In order to accommodate the reverse flow of responsibility, all avenues of control must converge gradually to the central point where is placed the authority that, by means of decentralization, assigns to the organizational units their respective functions. There must be this central point of control, which is of course the central headquarters, remote though it may be from local areas of activity. And finally, in order to complete the application of the theorem of communication, a central communication bureau must be set up at the central

division headquarters. At the central communication bureau are all the auxiliaries of communication, including the central complaint desk, telephone exchange, office intercommunication system, teletype sending and receiving machines, radio remote-control equipment, central division beat telephone network and recall system, alarm system, and disaster signal. Placed near enough to the record division to permit of adequate supervision are the central telephone exchange board and complaint desk, the agencies for receiving reports, complaints, and information which demand police attention. Sufficient data are obtained by the desk officer and operator to fill out the original report form, and the information is immediately given a serial number and routed to the record division. The central complaint room has an absolute control over the assignment of complaint serial numbers, and precinct stations are required to call either the record division or the desk officer to get a serial number for each report or complaint that may be received directly at such stations.

DECENTRALIZATION VERSUS CENTRALIZATION AND POLICE CALLS

The public instinctively considers central headquarters as the logical point of call when sending in an emergency or routine request for police assistance. In Chicago and in many other large cities, the report of a barking dog and the hurried notification of a holdup or murder are alike received at the central complaint room in general police headquarters, regardless of the geographical origin of such reports in the metropolitan area. The police foster this attitude of the public. In some large cities, indeed, the police have at various times conducted educational programs in an endeavor to make the public more conscious of the centralization at headquarters. The fact is emphasized that there is only one point at which calls for police assistance are received, and only a single police telephone number is given to the general public.

Advocates of decentralization point out that, in such centralization, time is lost in transferring the information to the point where action is needed. They direct attention to the

fact that a more definite establishment of precinct stations as police centers and the cultivation of neighborhood confidence in their personnel and equipment would do much to shift a large part of police business to precinct stations. It is at this point in the metropolitan communication scheme that the two forms of control can be utilized as alternative methods of operation.

In respect to the receipt of the original request for police assistance, the centralized arrangement in which all calls arrive at the central complaint room more nearly meets modern requirements. Confusion on the part of the public is eliminated, since there can be but one emergency police telephone number. With adequate personnel in the central complaint room and properly organized operating procedure, a large volume of traffic may be handled with a minimum of delay, and, through direct telephone and teletype facilities, traffic may be dispatched to individual precinct stations with little if any loss of time.

Moreover, the radio communication system, by virtue of its function in the emergency mobilization of patrol strength, is necessarily a highly centralized affair. Even the kind of equipment used in radio communication suggests the installation of a central transmitter. Indeed, until recently, engineering difficulties would have been encountered if an attempt had been made to install broadcast equipment at each precinct station. There were also to be considered frequency-channel limitations and cost of equipment, as well as other factors. Such a decentralized arrangement seems really unnecessary, as modern police transmitters are capable of covering large metropolitan areas from one centrally located point. Where plurality of transmitters was employed in order to obtain effective coverage, as in the Chicago installation, the control remained centralized, as all alarms were broadcast through microphones at the central complaint room.

The introduction of high-frequency radio systems into police service has in large part eliminated these various objections. The cost of this specialized equipment is comparatively

low and the problems connected with limitations of frequency channels and with interference have been circumvented by new methods of transmission. The use of this new equipment has been extended to mobile stations that have been installed in police cars as a means of decentralizing control of patrol cars for the duration of an emergency. Even during such operations, it is to be noted, headquarters maintains a constant check on all mobile broadcasts, so that control is continuously maintained. If precinct stations were thus specially equipped, a similar check against their broadcast operations would be a simple matter.

When police radio service was begun, questions arose respecting the record system and control over investigations. In some police departments there was a strong tendency to make the radio a controlling factor in police administration. In Chicago, for example, it was originally planned to install a central switchboard at police headquarters for that sole purpose, since the success of crime broadcasting by radio depended upon an expeditious relay of citizens' complaints.

The immediate effect of this plan, had it been put into execution, would have been to create a new and independent agency within the police department, which would have controlled completely the greater part of the criminal complaints. But since the police radio system was used only for broadcasting those major crimes which require emergency action, by far the greater number of citizens' complaints, many of which were of a grave character, would have been put to one side and there would have been no control whatever over their investigation. As now installed and operated, the new central switchboard is an integral part of the central complaint room, and its operator exercises an important influence in the expeditious handling of all complaints, and in the administrative control over their investigation.

Thus, in the metropolitan system of police communication, calls for police assistance and the broadcast of emergency reports, as well as the routine dispatching of ordinary traffic to precinct stations, are not only centralized but are also satis-

factorily under the supervisory direction of the record division. Up to the present time it has been the practice to restrict radio broadcast to reports of what are classified as emergencies—holdups, fights, murders, assaults, and other serious disturbances.

The use of radio service, however, is expanding and in a number of police departments neighborhood quarrels, barking dogs, ordinance violations, disturbances of the peace, and other happenings formerly classified as minor complaints are receiving the same service that is accorded the stickup and the burglar. With the inevitable development of this wider use, there will come a more urgent need for centralization of this facility under the supervision of the record division.

The police department's teletype network is again a centralized unit with lines radiating out from headquarters to all precinct stations. Two conditions might easily convert it into a decentralized system. In the large metropolitan area that we have contemplated, it might be necessary to set up divisional stations, each controlling a number of precinct stations. To the present central division headquarters in the city of Oakland, Calif., under such an arrangement, would be delegated the control of the present precinct organization in that city. This would require a teletype network between central division headquarters and divisional stations—a form of decentralized control.

Several attempts have been made to determine the feasibility of supplementing beat telephone equipment by teletype receiving machines. Such equipment distributed on beats would be under the direct control of the precinct station and would represent a true decentralization of this facility.

The metropolitan system, as so far described, is a highly centralized machine, with the incoming calls for police assistance, teletype, and radio under the absolute control of the central complaint room. It is now necessary to consider those communication facilities which become decentralized at exactly the same point as the organization itself, namely, the precinct station. These facilities include, principally, the beat

telephone and the recall systems. The services rendered are intimately interwoven with the police administration of the precinct, and under present conditions it would be a mistake to centralize them at general headquarters.

The commanding officer of the precinct is held responsible for the policing of the precinct area—a responsibility which, by the very nature of organization, invests him with the control of the force in that territory. By the same token he must be provided with a ready means of communication between the station and the dispersed members of the patrol force under his command. This means of communication he finds in the recall system, which, operated under his direction, gives him control of the precinct force through his ability to signal to any individual officer, any group of officers, or to all officers in the district simultaneously. Prompt action by the officer on the beat is thus assured not only on local complaints, but also on reports transferred to the precinct station from the central complaint room.

Through the beat telephone network, both the precinct commanding officer and the members of the patrol force may, if necessary, communicate with each other without delay. Regular reporting-in schedules are established, usually at one-hour intervals, and the calls of the various officers are staggered, so that the commanding officer has an almost continuous contact with the available patrol force. The beat telephone also supplements the signaling system, and thus makes possible rapid communication with the station when the recall system is in use.

The precinct complaint desk is unavoidably, in some measure at least, a decentralized unit, since many reports and complaints are made direct to precinct stations. These reports concern not only the precinct, but also matters of immediate interest to other precincts or to the entire police department, as well as information which may concern one or more outside departments. The appropriate police action is assigned for each report or complaint, and is accounted for to the record division at central headquarters. Adequate safeguards assure

the uninterrupted flow of accurate and complete records to the record division.

In some cities burglar- and holdup-alarm system lines are routed to precinct stations, where they are connected to the police communication system. However, since radio communication with mobile patrol units provides a most rapid mobilization of patrol strength and makes possible its immediate concentration in any quarter, it is logical that all alarm lines should terminate in the central complaint room, with its facilities for the dispatching of emergency alarms.

The introduction of two-way radio communication has been accompanied by an entirely new development in the decentralization of patrol communication. Upon its arrival at the scene of an emergency, a patrol car equipped for two-way communication may take charge of the situation for the duration of the emergency, and direct other radio-equipped patrol cars in the vicinity. Exits from the locality of the crime location may be cut off, roads blockaded, a cordon formed, and descriptions and other information pertinent to the crime broadcast direct from the patrol car that is at the scene of action.

This recent development in patrol service is destined to become an important factor in the general scheme of police decentralization. It is in accord with the fundamental assumption that any decision should be made at the lowest point in the organization at which are available all the facts necessary for a sound decision. Two-way radio communication thus introduces a refinement in decentralization in which headquarters temporarily relinquishes control of a part or all of the police force and an individual patrol car becomes the directing agency. In an emergency, indeed, the decentralized unit may request the help of headquarters in relaying assistance to outside departments.

From the foregoing, it will be seen that the communication system of a metropolitan police department is a combination of the centralized and decentralized plans of organization. The advantages claimed for each plan are met, in large part,

in the combination of modifications of both. If developments of the past twenty years are any guide for the future, the present trend of police service is toward greater decentralization, with the individual patrolman and his radio-equipped patrol car acquiring an increased significance as the ultimate unit of police protection.

COMMUNICATION RECORDS

Prerequisite to the proper coördination of communication facilities is the maintenance of complete and dependable records of the activities of this service. Communication records are primarily of two kinds: (1) the crime-record form embodying the information set down on the "original complaint form" and (2) the record form that concerns the operation and maintenance of the communication system.

Fundamentally, as we have seen, the record division and the communication system are inseparable in their actual operation. The communication system is therefore vitally interested in the procedure followed in setting down the original information obtained at the time that the call for police assistance is received. This procedure is as follows: At the moment that a report arrives in the central complaint room, the operator gets from the complainant sufficient information to start the investigation and officers are dispatched on the assignment. At this point record procedure begins. It is a fundamental rule in modern police service that a permanent record shall be made of all matters coming to the attention of the police which require investigation. It is therefore essential that a standard record form be used to accommodate the original information. The record designed for this purpose is known generally among police departments as the original complaint form, the shape, size, and arrangement of which are not material to this study. It might be pointed out, however, that the general lack of uniformity among police departments in this respect has been, at times, and with disproportionate seriousness, a definite handicap.[5]

[5] See Appendix 9, p. 537, for forms used in communication records and procedures.

Chapter X

POLICE COMMUNICATION UNDER DISASTER CONDITIONS

Police departments are usually so busy administering current business that they give little thought to the planning of police procedure for times of disaster or catastrophe, such as great earthquakes, fires, floods, or tornadoes, or for times of social disturbance, such as race riots, strikes, and political upheavals. Furthermore, they may function for years without ever being faced by the pressing problems which a great earthquake, fire, or flood brings; and this tends to lull them into a false sense of security—false because no community can be certain that it will not be the scene of the next disaster. And at just these times the police function has its greatest importance. Police departments have not yet learned the lesson which military men know well, namely, that effective work in times of stress and danger requires careful and detailed planning beforehand. Since the tasks facing a community at a time of catastrophe fall into two main divisions, the best organized plans are decentralized into two main parts. Division A deals with the protection of persons and property, rescue work, and the preservation of peace and order. Government officials, including the staffs of the various city or county departments, are made responsible for this work, and in it the Army, National Guard, reserve officers, the American Legion, and other veteran organizations can be of the greatest aid. Division B, which deals with public relief and rehabilitation, is usually taken care of by the local chapter and national offices of the American Red Cross, with the aid of other charitable and social service organizations.[1]

Coöperation and unified administration are secured through an executive committee known as the coördination committee or emergency council, consisting usually of the

[1] The San Francisco, Calif., Berkeley, Calif., and Pasadena, Calif., disaster plans follow this model.

mayor, city manager (if any), chairman of the local chapter of the American Red Cross, and sometimes of several other officials such as members of the legislative body and the heads of service clubs and other organizations that are participating in the disaster work. Some disaster plans may not distinguish so clearly two separate divisions, but the two kinds of work to be done are provided for in substantially the same manner.[2]

In all disaster plans the police department has the general police duties of maintaining order, protecting life and property, directing traffic, and caring for the lost and found. The police are also expected to aid other officials, make preliminary surveys of the extent of the disaster, and coöperate with the Army and the National Guard if these agencies are called upon. All these regular police duties assume unusual and difficult proportions. Traffic control especially becomes difficult, because of the large number of people who seek to escape from the ruined area and the large numbers who seek to enter it, either from anxiety for the welfare of friends and relatives or out of mere idle curiosity.

The protection of property from looting, and especially the guarding of banks and other places where funds and valuables are kept, are duties which the police are immediately called upon to assume. To mobilize the men on the force, to get data on the extent of the disaster, to summon aid and make reports to other officials, to keep in touch with the decentralized patrol force and direct its efforts, require communication facilities of the highest order. Unfortunately, it is just at this time, when communication is of paramount importance, that the regular channels of police communication are likely to fail.

In disasters of major importance, such as earthquakes or tornadoes, the telephone system is usually paralyzed.[3] The

[2] For example, see the Los Angeles Disaster Relief Plan. Charts of all the plans adopted in California may be found in *Disaster Relief 1932* (Disaster Relief Commission, American Legion, Department of California).

[3] In the San Francisco earthquake and fire, all but three of the telephone exchanges were burned and of the 50,000 telephones in operation

destruction of power stations and power lines, or the shutting off of power in the ruined area in order to prevent fires and accidents, may cause the total failure of the police signaling and radio systems. Destruction of telegraph and telephone facilities may make it impossible to summon aid from the outside when the assistance is vitally needed.

In the few disaster preparedness plans that have been formulated, scant attention has been paid to the communication need; some of the plans dismiss the subject with a cursory provision on the chart for a messenger service, or a message center, that relies upon the aid of Boy Scouts, motorcyclists, and airplane pilots. In others, the appointment of representatives of the telephone and telegraph companies on the executive or advisory committee is considered solution enough for the problem of providing adequate communication.

Private organizations interested in predisaster planning usually mention their own need of communication facilities. Thus, in *Disaster Relief 1932,* the California Department of the American Legion briefly mentions the necessity of providing for communication. The Red Cross disaster manual[4] provides for the appointment of a subcommittee on transportation and communication, whose membership should include such persons as railroad officials, officials of taxicab companies, and representatives of the Travelers' Aid Society and the local automobile club. The predisaster duties of this group are to make a survey of the transportation and communication facilities within the chapter's jurisdiction, to make a survey and inventory of the airplane and radio facilities of

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before the fire, not one was in working order after the fire had been brought under control. Of 83,000 telephones, 1 toll and 19 local exchanges in Tokio, the earthquake destroyed 52,000 telephones, the 1 toll and 15 local exchanges, and the four exchanges not destroyed were put out of commission. Telephone service was badly impaired in the St. Louis tornado of September, 1927, thus hindering the carrying out of a previously prepared plan for summoning policemen to duty in emergency by telephone. For a recent description, see Joseph A. Gerk, "How the St. Louis Police Department Met and Handled a Great Disaster," *Proceedings of the International Association of Chiefs of Police,* 35th Convention, June, 1928, p. 106.

[4] *Disaster-preparedness and Relief,* pp. 38–41.

the community, and to establish contact with and enroll the services of members of the "Army Amateur Radio System" and the Navy's "Naval Communication Reserves." This Red Cross manual lays a much greater emphasis upon transportation than upon communication.

These communication plans, drawn up for the respective organizations which they are intended to serve, lack the comprehensiveness which would make them adequate for a disaster plan of the community as a whole. They also lack the flexibility necessary to put them into operation without delay. Their functioning, as a rule, depends upon the assembling of a cumbersome array of committees whose first duty is to start the activities of the organization they represent. By this time, hours may have elapsed since the disaster occurred.

Manifestly, the police department of a city cannot depend upon the plans of these agencies for communication during a disaster. From the moment a catastrophe strikes the community, the police function is paramount, and a communication system which will fit police requirements is imperative. Moreover, this police-planned system can be made to fulfill the communication needs of all the agencies coöperating in the disaster project and thus achieve a unity in the governmental activities that is sadly lacking at present.

The procedure that is now described and recommended has never been included, so far as I know, in any predisaster system of planning. It may seem to some to be more elaborate than is necessary and too costly in time and effort to be practical. But no community is in a state of preparedness unless the plan provides for the ultimate in disasters—the destruction of the whole city or the greater part of it. Such cataclysms, as we have seen, do occur frequently enough to justify—indeed, to demand—the most careful planning in advance of their unexpected appearance. Preparation for the worst will afford adequate preparation for the less serious contingencies. Moreover, although the plan involves the initial expenditure of considerable effort and some funds, once this expenditure has been made the routine maintenance of the plan is not difficult,

and neither the initial outlay nor the upkeep is beyond the resources of an ordinary police department.

As the first step in the preparation of the disaster communication system, the police department should make a communication survey of the community.

Aside from the commercial telephone and telegraph companies, the facilities of which will be the mainstay of communication if they are not destroyed or paralyzed, the chief reliance in time of disaster must be upon radio communication, since its operation is independent of land-wire connections. The location of all commercial radio broadcasting and code stations, their sources of power, and their possession or nonpossession of emergency power-supply units which can be utilized in the event of the destruction of the regular power plants and lines, should be carefully ascertained and catalogued. Too much reliance cannot, in time of disaster, be placed upon commercial broadcasting stations. They would undoubtedly coöperate to the best of their ability, but most of their time on the air is contracted for long in advance, and since their use cannot be commandeered by the local authorities, any interference with these regular programs would mean a financial loss for which it would be necessary to compensate the station. Their use, therefore, might involve an expense which it is possible to avoid. There is available, however, a most prolific source of communication equipment, skill, and interest, namely, the amateur radio operators. Every city and town in the United States can boast of radio amateurs. These men are licensed by the United States Department of Commerce, which each year publishes a list of amateurs holding licenses, together with their call number, type of station, and other pertinent information.[5] A complete survey should be made of the amateur radio equipment within the police jurisdiction, including the number of operators, the location and type of equipment that each possesses, the source of power upon which each set depends, and any independent

[5] This publication may be obtained by addressing the Superintendent of Documents, Washington, D. C.

auxiliary source of power supply. Special note should be made of the location of amateurs who own portable transmitters and licenses for their operation.

From among the available amateur personnel, the police should organize a police communication reserve to be used in times of emergency.[6]

Several years ago it occurred to both Army and Navy officials that the amateur radio operators of the United States could be utilized to great advantage as a communication reserve and at the same time serve as a valuable training ground for the military and naval establishments. Accordingly, they organized the "Army Amateur Radio System" and the "Naval Communication Reserves," two nation-wide groups of amateur radio operators ready to serve at a moment's notice.

The territorial organization of both these groups is based upon the regular Army and Navy organization. The entire Army Amateur Radio System is controlled by a master control station at Fort Myer, Va., and operated by remote control stations. In each state in a corps area a control station supervises all the army amateurs in the state. Each state is also divided into districts, with district control stations from which the work of the individual amateur members of the system in that district is directed. Similarly, the Naval Communication Reserves are under the supervision of the senior central station at Washington, D. C. Each Naval district forms a district communication reserve and contains two amateur stations with a naval call, one being the control station and the other functioning as an alternate control station. The district reserve is, in turn, divided into sections consisting of a large city or some other geographical area, and each section is decentralized into a number of units, each comprising a varying number of amateur radio stations.[7]

[6] The willingness of the amateurs to aid in disaster work is shown by a news item in which the East Bay section of the American Radio Relay League offered their services to the city manager of Oakland, Calif., in the event of an unforeseen emergency which would cripple existing communication facilities. This attitude is typical of the entire organization.

[7] As a concrete example, the Naval Communication Reserves in the

Weekly drills are held in both systems, starting from the lowest units of the network and progressing until the corps area or naval district is reached. The Naval Communication Reserves on the West Coast hold a weekly drill between San Francisco, Seattle, Los Angeles, San Diego, Oakland, and Honolulu, covering several naval districts. Frequent national drills are held by both organizations to test the speed and preparedness of the members.

The value of these two reserve organizations has been proved in many situations. The work that the local organization of the reserves is in a position to perform is well illustrated by two incidents that occurred in California in 1932 and 1933. When a sudden flood swept down the Tehachapi Pass, spreading death and destruction in its wake, members of the Army Amateur Radio System at Bakersfield, Calif., by means of portable radio equipment established contact between the place of the disaster and Bakersfield, when all other facilities of communication were disrupted. In January, 1933, heavy snows tore down three miles of telephone poles at Palm Grove, Calif., cutting off all communication with that small community. An army amateur radio operator established communication with Los Angeles and so made it possible to stop automobiles from setting out along the roads which were blocked with snow, and to obtain supplies which were badly needed. For three days all communication between Palm Grove and other cities went through the amateur station.

The potential value of these organizations in times of disaster was recognized by the National Red Cross, which in 1930 developed a plan by which its national headquarters,

12th District cover northern California, Nevada, Utah, and Colorado. The control station is situated in San Francisco, the alternate station is in Oakland. Section 1 comprises Oakland and the east shore of San Francisco Bay and has four units; Section 2 covers San Francisco and its peninsula, with four units; Section 3 is the San Joaquin Valley, and includes three units with two others planned; Section 4 is the Santa Clara Valley and Coast, with four actual and one planned units; Section 5 covers northern California and contains six units; Section 6 comprises Nevada and has two units; Section 7 is the state of Utah, with one unit at Salt Lake City, and Section 8 is the state of Colorado, in which are located two units.

area branch offices, and local chapters could utilize these reserves in sending messages when normal lines of communication are inoperative.[8]

No attempt is made by either the Army or the Navy to enroll all amateur radio operators in its reserve organization. Since the Naval Communication Reserve, unlike the Army Amateur Radio System, is composed of regularly enrolled Naval Reserve members, subject to call to the regular naval service in time of need, every member of this organization must meet the rigid physical requirements for enlistment in the Navy. This prevents many fine radio amateurs from joining the service. These requirements do not operate in the Army Amateur Radio System, a strictly civilian organization.

Both systems attempt to enroll only a sufficient number of amateurs to make up a complete communication reserve in each section of the country. Of all the amateurs available, choice is made of those having the best equipment and the most suitable location. A locality may therefore have many more competent operators than are required or utilized by the Army and Navy systems. The police department thus has a greater amateur radio reserve to draw from than the entire group represented by the members of these two systems.

The police communication reserve should include those amateurs living in the police jurisdiction who are best qualified by experience, and who have the best equipment. Every attempt should be made, however, to include in the police communication group some members of the Army and Navy Amateur Reserves. Conversely, all the regular police radio operators who can qualify should enroll in one or the other of the military communication reserves. The police and military systems will not conflict, but will rather supplement each other.

The primary purpose of the police network is to set up or maintain complete intracity or -district communication.

[8] American National Red Cross, *Annual Report*, June 30, 1930, p. 29. *Annual Report*, Chief Signal Officer of Army to Secretary of War, 1930. *Annual Report*, Secretary of the Navy, 1930.

Through its interlocking membership in the two military networks, it will be able to provide intercity and interstate communication. The use of members of the military communication reserves in the police communication system would not be allowed to interfere with their duties in these organizations. In emergencies where the military forces are not called upon for assistance, the use of these men in the police communication reserves would give them valuable practical experience.

In grave situations where military strength is required to supplement the regular police force, the use of these amateurs by the Army and the police would very often be the same in scope and in purpose. In serious situations that require the establishment of martial rule there would of course be no conflict, since in such contingencies the military would entirely[9] supplant the police force in maintaining order in the community.

Besides the amateur radio network, which should serve as the backbone of the disaster communication system, the communication survey should not overlook other valuable sources of aid. Almost all the existing disaster plans provide for a message center to supplement other communication facilities. This center can make use of Boy Scouts as messengers and signal agents, since many scouts are proficient in the art of wigwag signaling. Lists of persons with motorcycles and automobiles who are willing to coöperate in the formation of a motor unit for communication and other purposes, should be prepared.

Airplanes can be very useful in times of disaster in surveying the devastated area, in transmission of messages, and in carrying passengers and bringing aid to isolated victims.[10] A

[9] In respect to members of the Naval Communication Reserves, the situation is slightly different; its members are regularly enrolled Naval Reserves, whose first duty, under the law, is to the Navy. This difference, however, would obtain only in a disaster that made necessary a call to duty by the Navy.

[10] The great value of airplanes in disasters has been clearly demonstrated in several catastrophes, including the New England flood of 1927 and the southeastern floods of 1929. The Red Cross has developed

number of police departments have already included the airplane as part of the departmental motor equipment, and have equipped these planes with two-way radio communication apparatus so that direct contact is possible between the plane and police headquarters and the ground force.[11] Where the police do not own airplanes, a survey should be made of the civilian and commercial airplane resources of the community and a list made of those which would be available for use in times of disaster.

The survey should also include the extensive communication resources of railroad companies whose facilities serve the area covered by the disaster plan. Inquiries addressed to the major transportation companies in the United States have brought assurances of their willingness to coöperate with the police authorities in situations where normal communication facilities are disabled. In the words of R. D. Starbuck, Executive Vice-President of the New York Central Lines, "In the event of a major catastrophe, the railroad company would of course take immediate steps to restore its own lines of communication which are necessary in the operation of its trains, and under such conditions would coöperate with the police authorities in the use of such communicating system to the extent of its capacity pending the reëstablishment of regular lines of communication."

Disaster communication preparedness is not finished when the organization of the communication reserves has been completed. The organization is valueless unless it is kept up to date and in working order by frequent drills and constant

what is known as the Red Cross Air-Ground Message Code, which, in the absence of radio equipment, may be used by members of the Air Corps of the United States Army and other aviators for communication with marooned populations in a devastated area. For this code, see the disaster manual of the Red Cross, App. IX, p. 70.

[11] In 1930 the New York City Police Department created an air service division equipped with 4 amphibian planes and 1 land plane, and employing 12 pilots and 24 mechanics. This experiment proved successful and the division has been continued. In 1931 the personnel was reduced to 6 pilots and 14 mechanics, but more miles were flown and more flying hours were recorded than in the previous year. See *Annual Report of the Police Department of the City of New York*, 1930, pp. 63–65; *ibid.*, 1931, pp. 169–170.

revision of the lists. The necessity of frequent drilling of the police amateur reserves cannot be overemphasized, for such drills are essential in keeping up the interest of the members and giving them the practice that will ensure their proper functioning in time of need. Both the Army Amateur Radio System and the Naval Communication Reserves drill once each week and hold national and special operations frequently. The police communication reserves would do well to follow this practice.

The lists containing the names and addresses of persons who have volunteered to give aid or equipment in the event of disaster must be periodically revised for changes of address, etc. Practice in operation should be had at varying intervals for the benefit of certain volunteer organizations, such as the Boy Scouts, who should be given opportunity to participate in mimic emergencies. The remaining personnel, for whom periodic drilling would be impracticable, should be assembled several times a year, and, in between times, literature should be distributed by mail in order to maintain their interest and to keep them well acquainted with the work that they have undertaken to do in an emergency.

How much special equipment for disaster communication should a police department own? When all regular communication facilities have been destroyed, the police communication problem approximates that of military communication in the field. To meet this need the Army uses the following facilities: wire communication, including the telephone and telegraph, the radio, visual signaling, messengers, and homing pigeons.[12] Theoretically, it might be maintained that a police department should be equipped with all the facilities used by the Army in order to be completely prepared for disaster communication. Practically speaking, this would be impossible, and it is also unnecessary.

[12] U. S. War Department, Training Regulations, No. 160–5, "Signal Communication for All Arms and Services." For a complete description of military communication equipment and practice, see the following: *Basic Field Manual*, Vol. IV, *Signal Communication; Signal Corps Manual*, Vol. I, *Signal Troops; ibid.*, Vol. II, *Signal Corps Operation.*

Some may hold that the police do not need any special disaster communication equipment, because, in any major contingency, the military forces are usually called out and they can supply adequate communication facilities both for themselves and for the police; until the military forces arrive, the radio facilities of the police communication reserves, and perhaps of the police department, will suffice. This idea, which is more or less generally held, involves no expenditure by the city concerned and shifts the burden of disaster communication upon another agency of government, and so may appeal to those who hold the pursestrings of the community, and who may be inclined to overlook other considerations.

Great disasters or extreme emergencies in the United States have almost always found either the Federal troops or the National Guard on the scene.[13] When these forces arrive, they bring with them the facilities for maintaining peace and order in the district, including, of course, necessary communication equipment. Some time may elapse, however, before these forces reach the place where they are needed. Requests for Federal troops are usually made to the governor or legislature of a state and such formalities take time.[14]

Even if the proportions of the disaster are so great that the corps area or local commander of troops will take action on his own responsibility and without awaiting orders, the troops may be stationed at some distance from the stricken area and thus not be instantly available. The National Guard may be

[13] From the time of the adoption of the Constitution of the United States to 1925 Federal troops have been used in the suppression of domestic disturbances on more than one hundred separate occasions. See *Military Aid to the Civil Power*, General Service Schools, Fort Leavenworth, Kan., 1925. Examples of the use of the National Guard are innumerable.

[14] For a discussion of the legal basis of military aid to the civil power, and the occasions on which the Army and National Guard will render such aid, see War Department, Army Regulations, 500–60; *Military Aid to the Civil Power*, General Service Schools, Fort Leavenworth, Kan., 1925; and publications of the National Guard of the several states, such as *Employment of Troops of the California National Guard in Disaster*, Special Regulation No. 3, prepared by the 40th Division Staff, State of California, Office of the Adjutant General, Sacramento, Calif., January 1, 1928.

called out, but it may not possess all the necessary communication equipment. In this interval, unless the police are prepared with sufficient equipment, the community is exposed to the dangers of inadequate police protection.

There are other considerations to be borne in mind. Although the military forces have always been and are ready to assist in cases of genuine need, there is a justified feeling among Army officials that the civil authorities are sometimes too prone to shift their burdens and responsibilities upon the military when this is not absolutely necessary. They feel that a little planning and foresight on the part of the police authorities would enable them to handle alone, or with the aid available in the community, many situations which the military force is now called upon to cope with.

The unprepared state of most communities and of their police departments for a disaster would lead one to suspect that there is much truth in this opinion. A police department with a well-prepared plan of disaster communication, supplemented by equipment necessary to the operation of the plan, would insure itself against such criticism. The total amount of special equipment required is not large and the cost is well within the means of any community large enough to need a disaster preparedness plan.

Some of the methods of communication used by the Army in the field are provided in the disaster communication plan, while others are of so limited usefulness that it would be impracticable to include them. Messenger service is provided for through the use of Boy Scouts and men equipped with motorcycles and automobiles. Visual signaling in a limited way can be furnished by the Scouts who are skilled in the use of the wigwag and any grown men in veterans' organizations who may be trained in such work. Some disaster plans have set up a simple code of audible signals using factory whistles or special sirens located at strategic points.[15]

[15] The Providence, R. I., disaster plan provides for sending signals to relief workers by factory and locomotive whistles, should telephone communication be destroyed. Berkeley, Calif., is provided with a powerful siren placed on top of the tallest office building in the city, to assemble

More elaborate provision for visual and audible signals is impracticable because of the limited usefulness. The police might even use homing pigeons if arrangements had been previously made with some fancier's loft. Pigeons will not stay away from their home loft more than seventy-two hours, and their use is attended with some difficulty, so that it is not advisable to depend upon them except under extraordinary conditions.

Wire communication by telephone and telegraph, and radio, remains to be considered. Undoubtedly field telephones and telegraph sets would be of great benefit to the police in disasters. Satisfactory transmission over field telephones ranges from nine to twenty miles, depending on various factors such as type of wire used, insulation, and construction. Field telegraphs may use the same lines as the telephone, and they have a much greater range than telephones over the same circuit.

Field telephones and telegraphs are easily constructed, for the wires may be strung hastily on all sorts of objects, or may be laid upon the ground.[16] Telephones must of course be of the local battery type to be usable in the field. This type of telephone is no longer used commercially except in some rural areas, and it is doubtful whether the telephone companies stock local battery telephones at all or in sufficient quantities for the police to rely upon their stores in case of need.

Neither can the police borrow field communication equipment from the Army, which is completely equipped in this respect, but which cannot lend to other agencies any equipment from its storehouses without specific authorization from the Secretary of War. If the military forces were called out, they would bring their field telephones with them, as they did in San Francisco in 1906, and the police would be invited

the police and fire departments in times of emergency. If the buildings were not destroyed and the power lines were intact, this would prove very effective.

[16] When the telephone company was reëstablishing temporary service after the San Francisco earthquake of 1906, a line from one of the intact exchanges to the Ferry Building was strung along buildings and posts of all kinds, and even dropped into the street slots of the cable cars.

to make use of them. But in disasters where the police can cope with the situation alone, this Army equipment will not be available.

The police will therefore be forced to buy field telephone equipment if they are to count upon its use in emergencies. The expense that the purchase of field telephone and telegraph equipment would involve, and the fact that radio equipment would in all probability fill the communication needs of the police in a disaster, make it inadvisable to include field telephone equipment in the emergency plan.

By a process of elimination we have narrowed down the special equipment necessary in the emergency police communication plan to the radio equipment. For communication with the outside world, and for communication with all strategic points in the devastated area, the only equipment needed is the necessary number of high-frequency portable radio transmitters. The police communication reserves satisfy the requirements of the first function, and this arrangement is supplemented in any one of a hundred or more cities in which police departments are already equipped for one-way radio communication with the patrol force. Standard police transmitters may be employed for communication over limited territorial distances, since in some places this equipment has an effective service radius of a hundred miles or more.

At least one portable transmitter is needed by each department to serve as a central control for the police amateur radio reserve net in periodic drills and emergencies. In cities with a large area, it may be desirable to have several portable transmitters placed at various strategic points.

The rapid expansion of two-way radio communication in regular police patrol service is providing the basis for a powerful and effective system of communication between headquarters and the affected area in disaster or other emergencies. With high-frequency transmitters installed in patrol cars, these flexible units are constantly in two-way communication with headquarters, and with other patrol cars so equipped. Where necessary, each car may be stationed at a

strategic point to function as a decentralized police station, issuing orders and instructions direct from the scene of action, and at the same time keeping headquarters thoroughly informed of the state of affairs in the area. Ordinarily, these cars may be permitted to continue to patrol the area, since two-way communication may be carried on en route equally as well as at the fixed post.

Through this extremely flexible avenue of communication, all direct police functions may be competently discharged, and the work of relief and rehabilitation facilitated. The ability to place two-way patrol communication in the field gives to the police department a large measure of desirable, if not absolutely necessary, control over all postdisaster operations.

Regardless of the division of the disaster plan into two major parts providing separately for the usual police duties and for relief and rehabilitation, the operations are so closely related that their proper coördination is dependent upon the existence of one central directing authority. Up to the point where martial rule is declared, the fundamental nature of the police duties suggests no other alternative than to lodge that authority at police headquarters. Any other organizational arrangement must lead to confusion and delay at a time when rapid action is most imperative.

The provision of power supply for transmitters is important. Patrol-car transmitters, of course, are operated by batteries and generators installed in the car and so they are independent of any commercial source of current supply. The greater number of central-station transmitters, however, receive their power from the commercial mains and, in the absence of auxiliary power equipment, would immediately become inoperative if either the power plant or transmission lines are destroyed or paralyzed. Many radio-equipped departments are providing themselves with gasoline-driven generators, battery units, and other similar equipment which can be promptly placed in operation should the commercial power fail. Because of the dependence which must be placed upon

radio communication under disaster conditions, no department should delay in making provision for this auxiliary equipment. Its cost of installation is comparatively low, yet in time of dire need it is literally beyond value. Attention should also be directed to the possibilities of the multifold carrier current control system of communication over commercial light and telephone lines under disaster conditions. The chief usefulness of this system lies in the fact that even though grounds and broken and short circuits may have occurred in these lines as a result of the disaster, the transmission of signals may go through just the same.

Quite apart from the catastrophe or calamity arising from physical causes, a disaster communication organization may prove of great usefulness in social disturbances, such as prison outbreaks, race riots, industrial disorders, and political upheavals, which may break out at any time and prove destructive to both life and property. The events of the last few years have shown how frequently such disturbances occur and how necessary it may be for the police to be prepared in advance to meet them. In many of these situations, violence has been lessened and communication has been provided through the ordinary police-communication facilities. With these events we are not here concerned. When, however, such disturbances involve widespread destruction of property, including the destruction or crippling of the communication facilities of the city or of the police, or of some other essential utilities of the community, the problems facing the police would be identical with those attendant upon destructive flood, earthquake, or fire.

Chapter XI

COMMUNICATION AND DISTANT IDENTIFICATION

The first known scientific observation on finger ridges was made in 1686 by Malpighi, the father of the science of histology and a professor of anatomy at the University of Bologna, who tersely alluded to the ridges which "describe different patterns." In 1823, J. E. Purkinje, a professor of anatomy at the University of Breslau, in a Latin thesis commented upon the diversity of ridge patterns connected with the organs of touch and even evolved a vague differentiation of these patterns[1] into nine varieties.

In order to lessen the difficulty of dealing with large collections, Sir E. R. Henry, Commissioner of Scotland Yard, London, devised a simple, yet comprehensive system of classifying and filing prints. His system was successfully introduced into England and Wales in July, 1901, and it forms the basis for the present system of fingerprint identification in the United States.

According to the Henry system, all fingerprint impressions are divided into the following types of patterns: loops, twinned loops, central pocket loops, lateral pocket loops, arches, tented arches, whorls, and accidentals. By means of these patterns, together with the ridges intervening and surrounding two fixed points, known as the core and the delta, a classification for the ten fingers is developed. This classification permits the filing of fingerprint records in sequence, without reference to name, description, or crime specialty of the individual, and, with some amplification and extension in the larger fingerprint bureaus in the United States, enables

[1] See *Criminal Identification,* by J. Edgar Hoover, Director, Federal Bureau of Investigation, United States Department of Justice, Washington, D. C. The interested reader is also referred to a number of other publications dealing with the identification functions of the Federal Bureau of Investigation, obtainable on request.

the fingerprint expert in a bureau containing millions of prints to establish an identification in less than five minutes.

Following the general introduction of this infallible system of identification, individual police departments immediately began the organization of fingerprint bureaus in which were catalogued and filed the prints of persons arrested locally. This limitation to the classification and filing of a few hundred local fingerprints inevitably proved a serious handicap. For the local bureau, operating independently and for all practical purposes isolated from other police identification bureaus, could not meet the demands of the department in the search for criminal records of arrested suspects who had come in from other places. Therefore, when the idea of exchanging fingerprints between the bureaus of neighboring police departments was introduced, its importance was at once appreciated by both the police and the criminal. This turning point in identification procedure marked the beginning of a rapid expansion in the functions and effectiveness of the individual identification bureau.

The identification bureau of each police department, instead of taking only one set of fingerprints of all persons arrested within its jurisdiction, took three or more, sometimes as many as thirty, depending upon the number of departments with which prints were exchanged. One print, properly classified and recorded, was "searched" and filed in the local bureau. The others were mailed to the outside police departments with which agreements had been made. Thus these police departments soon built up in their respective bureaus of identification comprehensive fingerprint files containing the records and prints of all known criminals or suspects in the territory covered.

But this plan, too, had limitations. Migratory criminals, the most elusive and dangerous of all criminal classes, seldom confine their operations to a localized area. They know no boundary lines and the state-wide and interstate scope of their activities is common knowledge. To meet this situation, there were two alternatives. The system of fingerprint ex-

changes could be extended to cover a large area, or all the police agencies in a given state might pool their identification resources in a centralized clearinghouse for criminal information. The first alternative was obviously impractical. The exchange of fingerprints among police departments within a comparatively small area was an economical and useful device, but when extended to include more than eight or ten police departments, it became cumbersome and unwieldy.

The nature of the problem, together with the advantages of centralizing criminal records, led to the creation of the state bureau of identification, to which all police agencies in the state might subscribe, and to which each department forwarded the fingerprints and records of all persons arrested and wanted. Thus was formed a huge centralized depository of criminal information covering a wide territory. One has only to glance at the annual reports of any one of these organizations to appreciate their value to society in the modern battle against crime.[2]

It was a natural development from this point to the creation of a bureau of identification which would serve the police departments of the country on a national scale. The United States Department of Justice had established a fingerprint bureau at the Leavenworth Federal Penitentiary, Leavenworth, Kan., in 1904, which at first contained the fingerprints from Federal prisons only; but its operations were soon expanded by the maintenance of a free exchange service whereby criminal records were received and circulated among a growing list of contributing police officers. Earlier, the In-

[2] Twenty-five state bureaus of identification are now in operation, and their number is constantly growing. Existing organizations are situated at: Albany, N. Y.; Austin, Tex.; Baton Rouge, La.; Bismarck, N. D.; Boston, Mass.; Charleston, W. Va.; Concord, N. H.; Des Moines, Iowa; Harrisburg, Pa.; Indianapolis, Ind.; Lansing, Mich.; Lincoln, Nebr.; Little Rock, Ark.; London, Ohio; Oklahoma City, Okla.; Phoenix, Ariz.; Pierre, S. D.; Providence, R. I.; Raleigh, N. C.; Sacramento, Calif.; Salem, Ore.; Salt Lake City, Utah; Santa Fe, N. M.; Springfield, Ill.; St. Paul, Minn.; Trenton, N. J.; Walla Walla, Wash.; Windsor, Vt.

Also see Appendix 10, p. 552, for condensed summary of *Report of the Activities of the California State Division of Criminal Identification and Investigation, for the biennial period ending June 30, 1936.*

ternational Association of Chiefs of Police, which embraces in its membership the heads of police departments of all the principal cities of the United States and Canada, had, in 1896, founded a bureau at Washington, compiling Bertillon records. As its members began adopting the fingerprint system of identification, this bureau gradually acquired a valuable collection of fingerprint records.

The growing and insistent demand by police officials throughout the country for one system of coöperation on a national scale finally resulted in the creation of the Identification Division, which was placed under the jurisdiction of the Federal Bureau of Investigation. In 1924, this newly organized Division received and consolidated in Washington, D. C., the records of both the National Bureau of Criminal Identification and the Leavenworth Penitentiary Bureau, and since its creation has shown a remarkable growth and development.

On May 31, 1937, it possessed 7,236,270 fingerprint records of actual current value and 8,457,284 name index-cards. More than 9000 law-enforcement agencies throughout the United States and foreign countries were submitting prints to the Bureau on that date. The degree to which law-enforcement officials utilize the services of this huge clearinghouse for criminal records is indicated by the following statistics covering the activities of the Bureau during the fiscal year 1935.

Free from political control and under the able leadership of Mr. J. Edgar Hoover, its Director, the Federal Bureau of Investigation, by its record of achievement, has demonstrated that it has no equal anywhere in the world. Through its Identification Division it has placed at the disposal of the police throughout this country a centralized reservoir of criminal records and information that has increased the effectiveness of police service in every community.

More than 5375 fingerprint records are now received daily by the Identification Division and each inquiry is answered by letter within thirty-six hours of its receipt. All peace officials are invited to avail themselves of the information con-

tained in the files of this Division. Its service is given to all legally constituted law-enforcement agencies, free of any cost; in fact, fingerprint cards and franked envelopes for the transmission of records to the Washington office are supplied free of charge.

Generally speaking, the methods of criminal investigation employed in the United States are similar to those followed by law-enforcement agencies in foreign countries. Fingerprints, photographs, modus operandi files, ballistics, handwriting, scientific laboratory analysis, and anthropometry are used in various combinations to form the basis of criminal identification in all the civilized countries of the world. In order to cope with the international criminal, many foreign bureaus now coöperate with the Federal Bureau of Investigation, in an international exchange of criminal identification data.[3]

Separated by comparatively great distances, these bureaus must be in intimate contact with one another in order to facilitate the intercommunication of criminal records and information with speed and dispatch. And the police department, immediate benefactor of this gigantic identification machine, must have at its disposal adequate facilities for rapid communication with identification centers, including more particularly the state and national bureaus, local police bureaus,

[3] One of the activities of the Federal Bureau of Investigation which has attracted widespread interest and contributed materially to the cause of more effective law enforcement throughout the world is its regular exchange of fingerprints with the identification bureaus of foreign countries. This project was instituted in March, 1932. Since that time the superintendents of identification bureaus in Accra (Gold Coast Colony), Algeria, Argentina, Australia, Austria, Bahamas, Barbados, Belgium, Bermuda, Brazil, Bulgaria, Burma, Canada, Ceylon, Chile, China, Colombia, Cuba, Czechoslovakia, Danzig, Denmark, Dutch East Indies, Egypt, England, Estonia, Federated Malay States, Finland, France, Germany, Greece, Haiti, Holland, Hungary, India, Iran, Iraq, Ireland, Italy, Jamaica, Japan, Kenya, Latvia, Lithuania, Mexico, New Zealand, Norway, Nyasaland, Palestine, Paraguay, Peru, Poland, Portugal, Pretoria, Republic of Panama, Roumania, Scotland, Sierra Leone (Africa), Southern Rhodesia, Spain, Sweden, Switzerland, Turkey, Uruguay, and Yugoslavia, as well as the superintendents of identification bureaus of all the territories and possessions of the United States, such as Hawaii, Canal Zone, Alaska, Philippine Islands, Puerto Rico, and Virgin Islands, have participated in this activity.

and those of the penal institutions. Communication facilities which may be employed for this purpose include correspondence, the long-distance telephone, the telegraph, teletype, telephoto, and television.

Actual fingerprint cards, which can be sent through the mails, present always the most definite and tangible means for positive identifications. Because of the accuracy and certainty of this method, it is employed almost exclusively. With the actual prints of a suspect in the hands of the fingerprint expert, an intelligent search may be instituted, and an accurate and absolute determination made of its identity with other fingerprints on file. In the periodical forwarding of fingerprint exchanges, the mails afford a slow but reliable means of contact. The spectacular development of air-mail service in the United States has done much to reduce the delay entailed by correspondence; special delivery and registered mail services are also employed where additional speed or certainty of delivery must be assured.

The mails, however, do not meet fully the requirements of the police for speed of communication in criminal identification routine. They will eventually be used, particularly in important matters, only as a means for confirmation of communications already forwarded in other ways which offer maximum speed plus a reasonable degree of accuracy.

It is agreed among experts that it is possible to make an approximate fingerprint identification in a long-distance telephone conversation. In a detailed two-way discussion, the formula, pattern, ridge characteristics, and other details of individual prints, the identity of criminal histories on file, and the comparison of personal descriptions, may be said to afford a basis for probable identification. This method, however, possesses the serious disadvantage of extremely high cost, particularly over great distances, and is used only rarely.

The commercial telegraph systems, particularly the Western Union and the Postal Telegraph companies, are peculiarly fitted to serve the police in emergencies when the rapid communication of a message between two or more distant

points is required. Their lines penetrate into every corner of the country and over cables to every part of the world, forming a network of communication available at comparatively small cost.

The police teletypewriter network possesses all the advantages of the commercial telegraph systems with the additional merit that it is operated and controlled by the police themselves, and is used exclusively for police purposes. An earlier chapter (Chap. VII) has afforded some idea of the widespread adoption by the police of the teletypewriter as a major instrument of communication.

The telephotographic system of communication is one of great promise in the field of distant identification. Known to the layman as a method of transmitting pictures by wire, telephoto makes possible the transmission of a facsimile of a set of fingerprints from one point to another, irrespective of the distance which may separate them. Obviously, this method approximates the actual comparison of the original prints. Identification experts, in the Identification Division at Washington, D. C., and elsewhere, have officially acknowledged the accuracy of identification of fingerprints transmitted by this method. Telephotography has passed the experimental state and is today a practical means of communication. In 1925, coast to coast telephoto operating circuits and equipment were placed in operation. The system is chiefly useful in the transmission of information in which form and arrangement are the essential factors. In this category, so far as the police are concerned, fall criminal fingerprints, handwriting, photographs, and certain forms of evidence.

It is to be recognized, however, that the elements of time and expense are of dominating importance in the electrical transmission of pictures. Present telephoto facilities are to be used only where the information must be received with greater speed than is possible through more economical methods of communication. The urgency of obtaining accurate information must be matched against the cost of electrical transmission, which at present is somewhat greater than

a

b

Pictures received over the Australian telephoto system: *a*, enlarged photograph of a fingerprint; *b*, enlarged section of a picturegram print in which the scanning lines are clearly visible.

the cost of telephone conversations occupying the same length of time. The average time required to transmit a set of fingerprints is approximately seven minutes.

Telephotograph service, or the transmission of pictures by wire, permits the transmission, over wires connecting any two points, of photographs, fingerprints, portraits, printed matter, lithographs, process prints, manuscripts, mechanical drawings, X-ray pictures, letters, messages, or, in fact, anything that can be photographed. Commercial telephoto service has been discontinued recently and all telephoto facilities have been leased to press organizations. A complete list of subscribing newspapers may be obtained from the Associated Press.

Telephotographic transmission, however, is commercially in its infancy. It is the history of all communication developments that, in the introductory stage, their general use is attended with expense. Improvement in equipment and operating technique will inevitably come and, with it, a reduction in the operating cost which will be reflected in a more nominal charge for its use. Expansion of telephoto facilities to include a greater number of key cities would undoubtedly follow quickly upon a demand for this form of communication traffic and further reduce its selling price to subscribers. When this happens, its increased use by police departments is indicated by the need for a more complete unification of criminal identification on a state and national scale.

The position of radio communication in respect to distant identification is a matter of speculation. The presence of other equally effective communication facilities for the purpose in mind, such as the telegraph and the teletype, and the probable expansion of telephotography, may divert attention away from radio, so far as distant identification is concerned. It should not be forgotten, however, that almost every achievement by means of land wire can be duplicated by radio transmission. Radio is a versatile instrument and has already been employed in picture transmission and in the simultaneous operation of typewriters at distant points. It might conceivably

displace both land-wire telephotography and the teletypewriter within a comparatively short time.

There is also the possibility of a police-controlled chain of radio stations operating in the higher frequencies and on organized traffic schedules. Although no definite progress in this direction has been observed, the police have been aware of the possibilities of a network of this type since 1920, when Commissioner James Higgins, of Buffalo, N. Y., presented a plan before the International Association of Chiefs of Police for an intercity radio system of police communication. In fact, radio was first considered by the police as a possible solution to the problem of interdepartmental communication. Its potential value in connection with distant identification is obvious.

Television should not be overlooked in any consideration of distant identification. A device that intrigues the imagination with its possibilities, it may, overnight, slip through the barriers that retard its commercial development and become of major importance in social contacts. The ability to "show up" a line of living suspects simultaneously in fifty or more cities throughout the country would certainly be embarrassing for the criminal. It is not difficult to foresee the time when, by means of television, an identification expert in Portland, Ore., and identification officials at Washington, D. C., may, as though side by side, make an actual comparison of two sets of criminal fingerprints, together with the accompanying photographs, descriptions, and criminal histories.

The chief physical difficulty in the development of television is the necessity of transmitting many more image elements than any physical means now available can generate, transmit, or recover. The number required is not yet agreed upon, but the indications are that it must be very much higher than anything yet attained.

In the transmission of sound, apparatus which will faithfully transmit the voice of a single person will transmit equally well all the voices of a chorus or the myriad tones of a symphony. The case of television is different. As the num-

ber of faces is multiplied, the complexity of the apparatus and the transmission facilities must likewise be increased.

The problem of developing and constructing television apparatus to handle satisfactorily extended scenes, such as the presentation of a group of criminal suspects, an athletic event, public ceremonies, of performances in theaters, is still unsolved. When the means are discovered or developed, it seems inevitable that the cost must be relatively high as compared with any other form of electrical communication.

The two-way television system which is in experimental operation by the telephone company transmits only a single face in each direction, yet it uses communication facilities which would carry about fifteen telephone conversations. The cost of performing this relatively simple television task would, on a commercial basis, be many times that of ordinary telephony. The cost of transmitting extended scenes by television must, so far as the communication-channel cost is concerned, be tens or even hundreds of times greater than satisfactory sound transmission. The future of television is therefore, in large measure, an economic question. When the public wants it sufficiently to be willing to make it profitable, it will undoubtedly become a commercially practical affair.

The most economical and satisfactory communication facilities at present available for distant identification are, therefore, the police teletype and commercial telegraph networks. Of these two, the police-controlled teletype system is the most practical.

The problem, then, is to find a satisfactory method of describing a set of fingerprints in message form so as to make identification possible in the absence of the original fingerprints at the point of comparison.

The desirability of identification by wire quickly became apparent after the widespread adoption of fingerprint identification. The subsequent establishment of centralized clearinghouses for criminal information at once made available to police departments exceptional facilities for fingerprint identification, but there was this limitation: a positive iden-

tification was dependent upon a comparison of the two sets of prints side by side. This involved a serious delay because of the necessity of forwarding prints by mail to the central bureaus.

In any alternative procedure, it will be observed, probability replaces certainty in the identification of fingerprints. It is fundamental in fingerprint identification that no method can take the place of actual print comparison in establishing absolute identity. This basic factor must enter into any plan for distant identification. When two sets of fingerprints, identical or not, which are filed at different points become the subject of communication by whatever means available, the hope for *absolute* identification must be abandoned. The degree of probability of identification is quite another question.

It is at this point that confusion arises. Unwittingly, various exponents of distant-identification systems have defeated their own ends by setting up the impossible objective of positive identification. A proposed plan is rejected or filed away in the archives of peace officers' associations for future reference because of the uncertainty of the identification which may be made thereby. Another system, which according to its sponsors will give absolute accuracy of identification, is too intricate and involved for practical application, and meets the fate of its predecessor. An ideal to be useful must be possible of achievement. Positive identification, desirable though it may be, is impossible of attainment in any present and practical system of distant identification, and it should therefore be abandoned as an objective, so that it may not continue to retard the development of this important matter.

A reasonable degree of probability is all that is required. Even in the actual comparison, side by side, of two sets of fingerprints that are apparently identical, the conclusion in respect to positive identification is governed by the laws of probability. Balthazar, who used one hundred possible comparison details in each print for purposes of calculation, estimated the chances of error as one in a figure that would extend the entire width of this page. Practically, any number of de-

details from thirty to a hundred might be used as the basis for expressing mathematically the probability of a print's being duplicated. Galton, whose figures are much the lowest of all investigators in this particular field, places the chance of duplication as one in sixty-four billions, which is four times the number of fingers in the world, counting the number of human inhabitants as 1,400,000,000, a recent estimate.

The entire thesis of fingerprint identification rests upon this degree of probability. The purpose in distant identification is to establish a reasonable probability of identification, sufficient for just cause to hold a suspect pending actual examination and comparison of the prints. With this appreciation of the limits of the problem, it is possible to consider by what method the distant identification of fingerprints may be made.

Here the coded message is of unlimited usefulness, its function being, not secrecy, but rather accuracy and economy in transmission. The principal elements of fingerprint classification and identification lend themselves admirably to detailed description. It would be possible, for example, for a fingerprint expert to describe a set of prints so completely that another expert, many miles away, might intelligently search his files and make an identification. The distant-identification code makes possible detailed analysis and at the same time reduces the length of the message so that the cost of transmission, even over commercial telegraph lines, is negligible. Thus, an ordinary ten-word message may contain information enough concerning a set of fingerprints to establish an identification with a degree of certainty approximating that of actual comparison of the original prints.

Police generally have recognized for some time the need for a code that would serve this purpose. More than twenty years ago, Thomas H. Guthrie, Secretary of Police of Columbus, Ohio, copyrighted a code for distant identification, copies of which he sent with an accompanying letter to police departments in more than five hundred cities in the United

States. In this circular letter, dated October 10, 1906, Guthrie said in part:

> I am enclosing herewith a copy of my police telegraph code, a glance at which will convince you that this is the thing that has long been needed by the police departments of this country. . . . I have furnished 500 of the leading cities of the United States with a copy of this code (a list of them is enclosed), and in a very short time expect to have at least 1000 of them in use. This will necessitate the publication of new lists of cities using them, from time to time, and one of these lists will be furnished you each time.
>
> A code of this kind would be useless to you or any other department if you were not kept informed of other departments that were supplied with them; therefore, the only way to successfully handle an enterprise of this kind and to keep other departments informed concerning the various cities using them, is to handle the business from a central office. The time is opportune for the police departments of this country to work in unison, and this is a step in the right direction.

For various reasons, Guthrie's plan failed of widespread adoption; but the ground was broken. Speaking at the 1922 convention of the International Association of Chiefs of Police, Chief Quigley, of Rochester, N. Y., brought the subject into the foreground, pointing out that no satisfactory system had yet been developed which would make it possible to wire fingerprint classification in such a way that identification could be made or denied immediately. When the classifications were supplemented with Bertillon measurements, a greater degree of accuracy was obtainable, but the procedure involved was clumsy and uneconomical. At that time there was another difficulty. Since the system was comparatively new, the time in which to train men in this field was very short, and consequently there were only a few fingerprint experts in the United States. Fingerprint identification had yet to become the highly specialized police function that it is today; but it did not take long to do it.

The speedy and almost incredible expansion of the use of fingerprints as the principal means for criminal identification in police service made more apparent the necessity for a suitable identification code. Unintelligible telegraphic requests to the central bureaus, asking for information or iden-

tification of some individual who was being held in custody, were received daily, such as, for example : WIRE RECORD JAMES MCPHERSON ONE ULNAR OVER ONE ULNAR OO OVER OO TWELVE OVER TEN. To such a communication it was difficult for the bureau to give a helpful reply. The information contained in the message was insufficient for an identification or even a verification of one, since from two to a hundred or more sets of fingerprints might bear this same classification or an approximate one. The primary, as given in the foregoing telegram, indicates that all ten digits are loop patterns; the first subclassification shows both index prints to be ulnars; and further shows that the index prints have more than nine ridge counts and that the middle fingers have more than ten. The only actual ridge count given by the communication is that of the right and left little fingers. Quite clearly, the mere transmission of a fingerprint classification formula is insufficient for identification purposes.

The solution of the problem lay in the formulation of a definite code, by which a single word or combination of words would indicate the type of pattern and the individual ridge counts, and give an accurate description of distinctive pattern or ridge peculiarities and characteristics in such manner that an intelligent search might be made in a central bureau, regardless of the number of prints on file.

The Jorgensen system.—The subject of distant identification had also received attention abroad. In 1914, Haakon Jorgensen, Assistant Commissioner of Police in Copenhagen and Lecturer at the University of Copenhagen, in an address delivered at the First International Police Conference in Monaco, presented a system by which it was possible to create a fingerprint formula supported with sufficient detail to make possible an identification at a distant point. In this classification of fingerprints, Jorgensen used the ordinary fingerprint glass specially ruled so as to divide the print into definite segments to which were assigned permanent numerical values. This was the working basis of the system. In 1916 a textbook on distant identification appeared and courses of instruction

were offered at the Danish Police School. By January, 1917, there was published the first fingerprint lexicon, containing the coded fingerprint classifications of more than 7500 professional criminals.

By 1922 Jorgensen's system had been successfully demonstrated and the identification bureaus of Amsterdam, Geneva, Berlin, Stuttgart, Dresden, Munich, Hamburg, Vienna, and Warsaw expressed their willingness to coöperate in working out a plan for the international identification of criminals through the adoption of this system.

In the plan that he presented, Jorgensen made use of the fingerprint identification technique that had been developed by Henry, Vucetich, Roscher, Daae, and others, and also of the Oloriz-Aguilera system of distant identification. Fundamentally, his technique was much the same as that employed in modern single fingerprint systems, in that the individual print was decentralized into definite sectors. Each sector, bearing an individual code designation, could then be conveniently described with respect to peculiarities of ridge formations and detail by numerical code assignments to eyes, forks, terminating ridges, deltas, and other ridge characteristics, and to their position in the individual sector. General fingerprint patterns, including whorls, loops, arches, tents, accidentals, central pocket and twin loops, were also given permanent code numbers. It was therefore possible to construct for any given set of fingerprints a standard numerical formula which would be identical with that for the same set of prints classified at another place. Jorgensen's technique differed from the others mentioned in that the formula contained in code form such complete and detailed information concerning pattern and ridge data that fast and positive identification was certain even though search was made in files containing 100,000 prints or more. The formula consisted of figures only, thus avoiding any linguistic complications.

Following the adoption of Jorgensen's code by the International Police Conference held in New York in 1923, an effort was made to introduce the system into American police

practice, with the use of either telegraph or telephone. At that time some twenty-four fingerprint experts chosen from various sections of the country, and including William F. Hoffman, now Chief of the Pennsylvania Bureau of Identification, met at New York City to receive instruction in the system and its operation. Hoffman later described it as providing a practical and positive, but too intricate, means of identification; and because of its intricacy and the consequent difficulty of application in actual practice, the system never came into widespread use in America.

Jorgensen's plan really contemplated a world-wide fingerprint identification system and the establishment of a centralized international bureau to which the police of the various nations would forward fingerprints of known criminals whose activities were international in scope. To illustrate: An international criminal, Alexander Magindoff, alias Johann Goffmansky, alias Valentine Zargensky, alias Anton Lubinoff, was fingerprinted in Budapest after the World War, and a copy of his fingerprints was sent to the International Distant Identification Bureau in Copenhagen. This man was born in Moscow in 1881; he had previously been convicted twenty-five times, in Paris, Lyons, Hamburg, Berlin, and Budapest. He was again arrested in 1924 in Belgium, under another alias. The Belgian Ministry of Justice telegraphed to the International Bureau at Copenhagen for information and promptly received word that Magindoff was an international criminal and that his fingerprints would be found in Budapest. Full information was obtained from the police authorities at Budapest, and a dangerous crook was kept in custody.

After this centralized bureau was in full operation, it was Jorgensen's plan that each year an annual catalogue or lexicon was to be published, which should contain the code classification of thousands of known international criminals, and which was to be distributed to all participating nations and departments. Thus it would make possible the immediate identification of recorded criminals without the necessity of cabling to the central bureau.

The efforts of Jorgensen represent the first serious attempt in police history to make criminal identification possible on an international scale. But his plan, with its detailed coding technique, secured accuracy at the expense of simplicity, apparently a necessary evil associated with any attempt to base a plan upon the analysis of the single fingerprint. This condition has delayed the development and adoption of single fingerprint systems in the United States, and has resulted in a disappearing interest in the plan proposed by Jorgensen. Had he realized that, in distant identification, absolute accuracy is not a prerequisite, and that probable identification is sufficient justification for holding a suspect pending comparison of the actual prints, he might have reduced his system to simpler terms and made its acceptance more likely.

Furthermore, through the establishment of a uniform system of fingerprint classification and identification, Jorgensen sought to bring order into a confused international situation where various systems were in use. Captain Golden, of the New York City Police Department, in a comprehensive survey of criminal identification systems, found the Klatt system in use in Germany, the Jorgensen system in Denmark, and in Italy a system devised by a Dr. Gasti. In the Bureau of Identification in Brussels, classification and filing was done by a combination of several methods. In South American countries and in Spain, the Vucetich system was employed almost exclusively. The Parisian police used a combination of the Vucetich and Henry systems, and in Vienna the identification system was based on the Windt-Kodicek idea. In Norway, the Daae system was in operation, and in parts of Germany he found the Roscher system in use. The United States and England had adopted the Henry system exclusively. In presenting his system, therefore, Jorgensen was requiring the wholesale abandonment of twenty or more separate fingerprint classification and filing systems that had already been put in operation at the expense of much time, study, and work. Enthusiastic though convention delegates might be, the objection to change at home was a factor to

be reckoned with. Inertia is a powerful force and difficult to overcome in the inauguration of any sweeping reform or change.

The Collins system.—Jorgensen was followed by Charles Stockley Collins, who for many years was in charge of the Fingerprint Bureau of New Scotland Yard. Collins was aware of the urgent need for a uniform code system in the telegraphic transmission of the fingerprint formula. He developed, in 1914, a code for this purpose, but accompanied it with the caution that a "recognition" made solely by means of a code would at the most supply a "strong suspicion" and should never be relied upon absolutely; that it should be confirmed subsequently by comparison of the actual fingerprint impressions. He held, however, that an identification by this method should be sufficient justification for delay of release, sentence, or even trial, until confirmed or rejected by such comparison. In 1921, he issued a revised edition of his code. His system showed improvement in technique in this field, and its comparative simplicity, in contrast to the systems originated by Jorgensen and others, made it more easily adaptable to actual practice.

Collins essentially employed the fingerprint terminology set forth in Henry's epochal *Classification and Uses of Fingerprints,* dividing his code into two main parts. The first part dealt with types of pattern, ridge counts, and ridge tracings, and the other part concerned the location of ridge characteristics. In preparing a code classification, the prints are considered in standard sequence: right thumb, index, middle, ring, and little finger; left thumb, index, middle, ring, and little finger.

Part I of the system assigned definite code letters to pattern types, and it is possible to transmit an entire fingerprint classification formula in two words of five letters each, the telegraph companies allowing five letters to each word in code messages. When coding loops, the standard ridge count between the core and delta is inserted after the code letter, as, for example, D9 (ulnar loop with a ridge count of nine).

When coding whorls of central pockets which classify as inner or outer, the number of ridges intervening between the extended ridge of the right delta and that of the left delta are added to the code letter, as G4 (whorl—inner, with ridge count of four). This count is determined in exactly the same manner as when ascertaining whether a whorl is inner or outer under the standard Henry system of classification. A telegraphic identification on the basis of Part I of the Collins System, although not absolute, would alone, under ordinary circumstances, be considered sufficient ground for holding a suspect pending further investigation and actual comparison of prints.

In Part II of the system, Collins went farther, in an endeavor to supplement the actual formula by a simple method of coding definite ridge characteristics. Up to this point, no special glass or equipment is necessary, other than the ordinary fingerprint glass. For the purpose of coding peculiarities of ridge detail, he adopted a somewhat different plan of sectorizing the field than that employed by Jorgensen. Across the glass and near the center, two very fine horizontal parallel lines were drawn, six millimeters apart, which were joined together in the center by a third line perpendicular to both.

Whereas letters are used for coding types of patterns, numerals are applied to the coding of ridge characteristics, and only four identifying peculiarities of fingerprint ridge formation are considered, the pure ridge, the terminating ridge, the bifurcation, and the eye. When coding the formula of a set of fingerprints, it has never been found necessary to telegraph the ridge characteristics of the entire ten fingers; the coding of about fifteen characteristics was more than sufficient. Usually, the selection of only one of the ten individual prints provided more than the necessary information. The coding of ridge detail is always preceded by the code letter of the digit selected. Additional detailed instructions cover the position of the reading glass when coding the ridge characteristics of the individual types of patterns and there is also given a brief outline of the procedure to be followed.

Collins not only made a monumental contribution to the science of fingerprint identification, but also at the same time laid the foundation for a workable single fingerprint system, which continues to interest all students of criminal investigation and identification.

As explained by Collins, the system does not make possible absolute identification, even when the formula is supplemented with coded ridge characteristics. In fact, he makes the entirely correct assumption that a positive identification is unnecessary. Telegraphic identification through the use of this code should possess a sufficient degree of probability in identification to justify the authorities in holding a suspect in custody until the actual prints of his fingers can be compared with those on file.

The Wilder-Wentworth code.—In 1918, Harris Hawthorne Wilder, Professor of Zoölogy in Smith College, and Bert Wentworth, former Police Commissioner of Dover, N. H., compiled and published their treatise on the subject of *Personal Identification.* Included in this comprehensive work is a fingerprint-communication code by which it is possible to transmit intelligently by telegraph or other means of communication sufficient detail for a tentative identification. The system, in practical trial, has proved entirely satisfactory, and a number of police departments have used it to great advantage for urgent communication with the national identification center at Washington, D. C., and with state bureaus of identification. In this code, the types of pattern are arranged alphabetically, and the separate pattterns under each are arranged, as far as possible, with the number of ridges in numerical order. The code words are also in alphabetical arrangement, to be more readily found when translating a message.

In coding under this system, the fingers are considered in standard sequence, as on the regular uniform fingerprint card:

Rt thumb	Rt index	Rt middle	Rt ring	Rt little
Lft thumb	Lft index	Lft middle	Lft ring	Lft little

A typical Wilder-Wentworth code message describing a set of fingerprints taken from a suspect, would be as follows:

Wordy	Ladle	Upright	Wagon	When
Travel	Arbor	Celery	Always	Ruddy

The bureau or department receiving this message would refer to its code in much the same manner as to a dictionary and in a few minutes complete the translation and resolve the classification. The formula given is a comparatively unusual formula combination, and the average bureau would find very few prints bearing exactly the same classification. This formula may sometimes be considered sufficient, without supplementary information, to constitute a tentative identification. With the additional detailed data that is supplied by this ten-word message, however, a probable identification may be established irrespective of the size of the bureau or the number of fingerprints on file.

The Wilder-Wentworth code also accommodates Bertillon measurements and personal description. The use of this section of the code is generally limited at present to the transmission of hair color, eye color, height, weight and age, and identifying marks, as the Bertillon system has been largely superseded by fingerprint identification.

Distant identification offers important aid in tightening police control over the freedom of movement of enemies to the public safety. Facilities for its use are available, both state and national, and are increasing steadily, particularly the police teletypewriter networks. The Wilder-Wentworth code seems to meet the requirements of the situation, at least as a beginning, since it successfully ignores the more intricate details of single-fingerprint classification systems. In view of the importance of this matter, the establishment of a distant identification communication plan, including the national and eventually the international adoption of a uniform code, is a project that, it seems, is quite within the province of the International Association of Chiefs of Police, and it is to be hoped that summary action will soon be taken.

ARREST BY WIRE

Closely associated with distant identification is the problem of the telegraphic warrant. A warrant may be defined as a writ issued under the hand and seal of a magistrate or other person empowered by statute to issue warrants, authorizing an officer to arrest the offender involved. Fundamentally, the so-called telegraphic warrant, or request for arrest by telegram or other means of communication, does not meet these requirements, since it is essentially a reference to the original document, and is not primarily endowed with the arresting authority.

Since the criminal of today may cross county, state, and even international bundary lines as easily as the law-abiding citizen, and does so, the status and validity of the telegraphic request for the arrest of an offender or fugitive are of more than ordinary significance. If the arrest of a fugitive criminal were to depend on the efforts of an officer with a warrant trailing him from one jurisdiction to another, few such fugitives would be brought to justice. Although some cases may tolerate the delay incident to forwarding the original warrant by mail, more frequently than not time is the decisive factor and it is then that the telegraphic warrant becomes an effective instrument in the hands of the police.

A recent survey[4] disclosed that, in a number of states, statutes have been enacted recognizing the telegraphic warrant as a legal instrument, and in others its validity is in effect denied. The matter has been wholly neglected in some states, where neither statutes nor judicial decisions are on record concerning the rights of a peace officer when acting upon authority derived from such requests. Judicial decisions are as various as the states in which they have been rendered, as are also the statutes which have thus far been enacted. A number of important decisions have been handed down which directly empower the police officer to act upon telegraphic ad-

[4] This survey was based on replies to direct inquiries addressed to the attorney general in each state.

vice.[5] However, it has been held by some courts that an arrest made upon the authority of a telegram is wholly at the peril of the officer making it, and that a telegram affords no reasonable ground to believe that the person named in the telegram is guilty of the offense or that he intended to commit any offense which would justify his arrest.

Officers of the law are responsible in every jurisdiction for any unnecessary infringement of the rights and privileges of another person. If an officer, through negligence or misinformation contained in a telegram or other communication, arrests and detains any person not guilty of any offense, he is personally liable for the wrongful act.

The paradoxical circumstances surrounding the telegraphic warrant have been a source of inconvenience and embarrassment to police officers for many years, and the ends of justice have often been defeated for lack of authority to act. There is need for a uniform definition by the various states of the validity of this type of warrant. In the present confusion, forty-eight different interpretations may glorify the worn-out theory of states' rights, but they may also tie the hands of that body of men to whom the communities in forty-eight states must look for police protection.

Telegraphic advice within a state would concern that state alone, but the escape and migration of criminals is frequently interstate in character and therefore a fit subject for Federal regulation. Bringing this phase of the problem under the jurisdiction of the Federal government would result in the adoption of uniform procedure covering not only interstate arrest by wire, but extradition procedure as well. Recent events seem to reveal a definite trend in that direction.

Despite present legal barriers, sound public policy demands that a fugitive from justice be arrested immediately

[5] Brown vs. State, 62 New Jersey Law, page 695; State vs. Sage, 99 New Jersey Law, at 236; Cabell vs. Arnold, 86 Texas 102, 23, S. W. 645, 22 L. R. A. 87; Burton vs. New York Central & Hudson River Railroad (1911) (this refers to warrant dispatched by teletypewriter), 147 App. Div. 557, New York; Koscielski vs. State, 199 Indiana 546, 158, N. E. 902; Hangar vs. State, 199 Indiana.

upon receipt of official information from the place in which the offense was committed, and that the prisoner be held a reasonable time until a formal demand may be made for extradition. A fugitive, as here contemplated, is one who, having committed an offense contrary to the law of a state, takes refuge in another jurisdiction.

Peace officers are generally inclined to honor a telegraphic request from an outside department for the arrest of a fugitive, even though there may be no legal sanction for so doing. Fortunately, there has been little or no abuse of this unwritten understanding and there has been built up among police departments a mutual confidence, professional in nature, which is conducive to coöperation in such cases.

Some care should be exercised in framing a telegram for the arrest of a person at a distant point. Brevity should not be achieved at the expense of accuracy and completeness of information. The message should contain, besides information concerning the offender's probable whereabouts, the following data:

(1) Offender's name and aliases, if known.

(2) Description: hair color, eye color, height, weight, age, and any special marks of identification such as scars, tattoo marks, limp, or speech defects.

(3) Nature of the crime for which the offender is wanted.

(4) Fingerprint classification, if known.

(5) If the fugitive is known to be a desperate character, the arresting officers are entitled to receive that information.

Such messages should always be followed by a confirming air-mail letter, giving full and complete particulars. Upon being informed that the prisoner is under arrest, the inquiring department should lose no time in sending an officer with the proper legal instruments for the return of the accused to the jurisdiction where he is wanted.

Chapter XII

THE MODERN POLICE COMMUNICATION SYSTEM

We have considered the separate facilities that enter into a communication system. Let us now consider, in a broader perspective, three modern communication systems as complete administrative units. Two of the systems discussed represent two types of police organization—the large metropolitan area where administration is decentralized, and the city of smaller population and area where the police activities are centralized. The third system described is a projected plan of communication for the small community.

THE POLICE COMMUNICATION SYSTEM : LOS ANGELES

THE TELEPHONE SYSTEM

Before the Administration, the Central Detective Division, and the Central Record Division of the Police Department were moved to the City Hall, the switchboard of the police department was in the Central Police Station on First Street. It was served by telephone number Michigan ——, and operated by girls who monitored each incoming call and transferred it to the department concerned. Under this arrangement it was necessary for the calling citizen to repeat the information twice and sometimes oftener, as his call was transferred from one person to another. The switchboard was connected by lines with the City Hall switchboard, and the lines were used for interdepartmental business calls between personnel of the City Hall and the Police Department.

When the decision was made to move these three divisions (formerly called bureaus) of the Police Department to the City Hall, the matter of telephone service, space for the switchboard, and so forth became important. The City Hall, when built, was so arranged that one dial-type telephone exchange or switchboard sufficed for the telephone needs of all

the city departments in the building, and ample space for expansion had been allocated near this switchboard.

At first, a separate switchboard for the Police Department in its own quarters was thought necessary, but this involved a problem in the allocation of floor space and rather large expense in construction changes.

At this point in the planning, the telephone company engineers were requested to submit plans showing how best to move the Police Department telephone exchange, at the least cost for removal and installation and also for construction changes. After several conferences with the police, the following plan was accepted and the system installed.

(1) An addition to the City Hall exchange made possible the police use of the dial-type switchboard serving the City Hall, and the expense for the alteration was very much less than would have been incurred had a separate switchboard been installed.

(2) There were installed in the Police Department, at the City Hall, two double-faced switchboards (8 operator positions), much the same as those used by department stores for receiving orders. Locally, these are called "complaint turrets" or "complaint boards," and are used only for receiving requests, complaints, and information from citizens. Each switchboard requires from one to four operators, depending upon the volume of traffic. The apparatus is operated from two sides, facing each other, and there are two operators on each side when calls are frequent. A call can be shifted from one side to the other if necessary. The switchboards can be connected directly with outside lines for receiving complaints or information, or with the office lines for transferring calls, and they are so arranged that any operator can answer and call any police division or substation directly.

The telephone central lines of "Michigan" are connected directly with these complaint boards, enabling citizens calling "Michigan" to reach the Police Department without the services of an intermediary operator. The switchboards are operated by policemen instead of telephone operators.

Form 392

LOS ANGELES POLICE DEPARTMENT
CENTRAL COMPLAINT BOARD REPORT

OPERATOR

OFFENSE OR COMPLAINT

TIME OCCURRED

.....A.M. P.M. ..... 19.....

LOCATION

DIST. NO.

SQUAD CAR NO.

COMPLAINANT

ADDRESS

TELEPHONE

DETAILS, DESCRIPTION OF OFFENDER OR OF AUTO AND DIRECTION IN WHICH ESCAPED, ETC.:

DISP.

TIME REC'D

.....A.M. P.M. .....19.....

BROADCAST TO:

TELETYPED TO:

TELEPHONED TO:

If the call is for help or advice, usually the advice is given or the help sent by the switchboard policeman receiving the call. Occasionally, when the advice sought is too complicated, the complaint-board operator will transfer the call to that branch of the Detective Division which handles the particular kind of crime involved. The remote-control apparatus of the radio station is in the same room with the complaint board, and all calls requiring the broadcasting of information are dispatched immediately by the operators.

(3) All telephones in the Police Department headquarters, as well as those of the fifteen police divisions or stations scattered throughout the city, are connected directly to the City Hall dial switchboard served by Michigan ——. This enables the Police Department, the divisional headquarters or stations, and the City Hall in general, to intercommunicate directly by dial telephone. They also may obtain city connections by dialing directly into the telephone company's main exchange.

(4) All routine and personnel calls for the Police Department are received over the Michigan —— lines at the City Hall dial switchboard, where they are handled by girl operators. This relieves the police operators on the switchboards previously mentioned from routine switching or service.

Michigan —— is not listed in the telephone directory as a police telephone number, but all officers and patrolmen are specifically instructed to use this number on routine or person-to-person calls. Were the citizens to use this number in calling the police, their emergency calls would often be delayed.

(5) As it was thought probable that some routine police calls would be received over the emergency line, Michigan —— (different from the Michigan —— mentioned above), the telephone company devised a means for their rapid transfer to the City Hall switchboard. By pressing a key, the police operator on the complaint board transfers the call. He then disconnects immediately, as the call requires no further attention by him.

(6) In order to make possible the most effective handling of the more important emergency calls (for example, those relating to homicides and robberies), special devices were installed by the telephone company. When the call is received, the police operator on the complaint board depresses a key which sounds the alarm bell and at the same time connects him with a police stenographer in the teletype room; in this way a record of the details of the case is made immediately. The complaint-board operator at once broadcasts a description of the crime over the police radio, and at the same time the police stenographer who took the report broadcasts the information over teletypewriters to all divisional headquarters. Thereafter, the patrolmen in radio-patrol automobiles who may require more information than they were able to record, call their own divisional headquarters from the police telephone boxes to ask that the teletype report be read to them, thereby relieving congestion in the Central Complaint Room.

The stenographer's telephone is equipped with an amplifier so that several people may listen to the conversation. In case of robbery, the police operator on the switchboard, besides pressing the button for the stenographer, may also press a control which rings a bell and connects a telephone (equipped with receiver only) in the Business Office, and in the Robbery and Homicide Bureaus, where the officer in charge may listen to the details of the call but cannot in any way interrupt the conversation. This procedure enables three or more persons concerned to hear the report of the crime; and further, the possibility of human error is greatly reduced.

(7) The key arrangement controlling the emergency calls and the connections to stenographers and bureau heads is such that when one switchboard operator has established a connection with the stenographer, others are unable to make this connection, and interference is eliminated.

TELEPHONE SERVICE FOR THE CHIEF OF POLICE

The office of the Chief of Police is provided with key boxes which enable him or his secretary to talk or hold a conversation on any one of six lines. Furthermore, there is installed in his private office a board with twenty push buttons which give him intercommunicating and conference-calling telephone service with the Assistant Chiefs and the various heads of divisions. With but one telephone instrument upon the desk of the Chief of Police, this ability to talk on either of the telephone systems named is accomplished in the following manner.

(1) Six lines from the City Hall switchboard and the telephone company's central exchange are brought to the key box in the Chief's private office, and then extended to the office of his secretary.

(2) When a call arrives on any of these lines, a white lamp burns in both offices and a buzzer operates in the secretary's office. When anyone answers—for example, the secretary—the white light in both offices goes out and the buzzer stops sounding. Answering is made possible by turning the switch controlling the particular line to be used. When the line is in use and the white light is out, a green lamp indicating "line busy" burns in both offices.

(3) The secretary may transfer any call to the Chief, and in the event of a second call the secretary, by observing the green lamp, knows whether or not the Chief has finished his conversation occasioned by the first call, or if he is otherwise engaged on the telephone. This saves him the annoyance of a second call when he is already engaged in telephoning.

(4) The key box in the Chief's office is so arranged, also, that when all the keys are in a normal or holding position the Chief may connect his telephone directly with any one of the twenty intercommunicating telephones by pushing one of the twenty buttons on the box. At the same time, a signal lamp burns at the secretary's desk, indicating that the Chief is engaged on the intercommunicating telephone.

(5) The first operation of the button establishes the connection between the Chief and the division desired, and causes the bell at the division to ring. Each subsequent operation of the push button causes the bell at the called station to ring again.

(6) For conference purposes, as many as ten push buttons may be operated consecutively, thus connecting ten persons with the Chief. Connections thus established are broken when the Chief replaces the receiver on the stand.

(7) Divisions connected with the intercommunicating system are unable to connect with the Chief's telephone, all connections being controlled entirely by him. Any combination of divisions may be set up by operating various buttons, and released by replacing the receiver.

An intercommunicating system as outlined for the Chief of Police is also installed for the Assistant Chief, the Deputy Chief of Personnel and Equipment, and the Chief of Detectives. Each of these systems connects with the division or bureau heads with whom the particular officer most frequently desires to communicate.

THE RADIO COMMUNICATION SYSTEM

The radio equipment consists of one 500-watt De Forest radiophone transmitter, operating on a frequency of 1712 kilocycles. The Police Department has 80 Sparton automobile receiving sets. In each of the fifteen police divisions into which the city of Los Angeles is organized, and in several of the special bureaus at headquarters, a station receiver is installed. In each of the territorial divisions, the loud-speakers are attached and installed in the detectives' quarters. The walls of the transmitter room have been deadened by the use of a material known as "masonite," which creates ideal acoustical conditions for transmitting.

When the system of radio communication was first set in operation, the city was divided into radio patrol districts, and a street index was provided which would enable the operator to determine in fifteen or twenty seconds the radio

patrol district in which any street and number is situated. (As there are more than 7500 streets in Los Angeles, it required the work of five persons for a month to trace and typewrite all the street names and numbers.) It is impracticable to depend upon the knowledge of any person to direct the automobiles in the city without such an index. With it, a stranger in Los Angeles could direct the patrol cars as well as any one familiar with the city.

The fifteen territorial police divisions in Los Angeles have definite numbers. Central Division is No. 1, and has six radio patrol districts numbered 11 to 16. The first digit is the number of the division, and the second is the number of the radio patrol post or district. This system is applied throughout the fifteen divisions, the fifteenth having four radio patrol districts, numbered 151, 152, 153, 154. In the divisions bearing numbers 10 to 15, the first two digits signify the division number and the third digit the radio patrol district.

Each radio patrol district is divided into two sections, the second section being designated by the letter W; for example, District 11, Sections 11 and 11 W. If the call originates in the W section, the automobile patrolling that district is called by using the number 11 W. This indicates to the men in the automobile that the street will be found in the W section of their district, and in referring to their map, if they are not familiar with the street, they know that they must look in the section named. An added advantage of the divided districts is that, if increased police activity is required in a certain division, additional automobiles may be assigned to the two sections independently, and called separately, through the independent use of the numbers 11 and 11 W. Each automobile assumes the number of the district to which it is assigned for patrol duty.

By the use of this system each division commander can determine where any automobile in his division has been dispatched to take care of some police matter. If in his opinion it is a matter of great importance, he can dispatch the divisional emergency automobile to ensure that the call is an-

swered even if the message was not received by the men in the radio patrol automobile designated. By this system, when an automobile is sent on a call, the number of the division is automatically included in the broadcast.

Each message is broadcast once from the remote-control room, which is adjacent to the telephone complaint switchboard and the teletype room. The message is written and broadcast again by the operators in the radio station, which is in an isolated position in Elysian Park. This means that the entire message is given twice to the patrol cars. The repetition is practiced in order to ensure the receipt of messages. If during the first broadcast the automobile should be passing through a particularly noisy area, the patrolmen are instructed to turn into a side street away from power lines and other sources of interference, and listen for the second broadcast. The actual reception of broadcast messages has been approximately 99 per cent.

During the day watch, which is between 10:00 A.M. and 6:00 P.M., there are two men in each automobile, and it is assumed that both of these men leave the automobile to investigate any matter broadcast to them. For this reason, after a message has been sent to any car, that car is recorded as out of service until the men notify headquarters that they are ready for more business. If within this interval another call for help originates in the same district, the patrol car from an adjoining district is assigned to the duty indicated.

During the night watch, between 6:00 P.M. and 2:00 A.M., there were originally three men in each automobile, and one of them was instructed to remain with the automobile at all times. Only two men are assigned to each night-patrol car at the present time, owing to a shortage in personnel. The messages are broadcast to each automobile in the order in which they are received, and the cases are investigated by the patrolmen in the same rotation, or in accordance with the importance of the message.

The complaint-switchboard room is equipped with a large map showing all the radio patrol districts. Each radio patrol

car is equipped with a duplicate map on curtain rollers, attached to the ceiling of the car.

When a call is received by a policeman on the complaint switchboard, he writes the necessary data on a form provided for the purpose. The form is then passed to the index clerk, who searches the street index and finds the number of the district containing the address shown on the form. He writes the number in the place designated on the form and then consults his work sheet to learn whether or not the radio patrol car assigned to that district is in service. If the automobile is on a call and thus "out of service," he writes the number of the nearest available car in the space for "Squad Car No. —." He then passes the form to the radio dispatcher, who broadcasts the message, stamps the time on the form, and passes it through a wicket to the disposition clerk. The disposition clerk places the form in a compartment having the same number as the automobile to which the message was given.

Upon completion of the investigation, the patrolmen call the disposition clerk on the telephone and give him the number of their automobile and a report of what they have done. He takes the form from its compartment and records on it their report of the time elapsed between receipt of the call and arrival at the place to which they were sent, and of the action taken by them. This action is noted very briefly; for example: "Disturbance quieted"; "One misdemeanor arrest"; "Report made," etc.

The main reason for requiring these reports of the disposition of cases is to be certain that the call has been answered and the appropriate action taken. If, after a reasonable time, the patrolmen do not report action taken, they are called on the air and asked to report by telephone. If they report that they did not receive the original message by radio, it is given them by telephone; but the necessity for this seldom occurs. Major calls are telephoned also to division detectives, who likewise respond, thus ensuring action if the radio call is not received by the assigned radio patrol car.

In accordance with the requirements of the Federal Com-

munications Commission, a radio log is maintained, and when the disposition record is received, the information is entered as follows: the time the call was dispatched; the number of the automobile sent; the place to which it was sent; the reason for sending it; the time used up between receipt of call and arrival at destination, and the action taken.

Each radio patrol automobile is equipped with a large loose-leaf book in which are copies of the emergency report form, a copy of which is shown on page 373. By use of this form, the recording of a description is reduced almost to the brevity of shorthand. The officers at the complaint switchboard also use it in taking a description over the telephone, and when the information is broadcast the routine order of the form is followed, so that the patrolmen in the cars can enter the description point by point on the form in a regular order.

Copies of all teletype messages with reference to crimes committed, automobiles stolen, persons missing, and so forth, are delivered to the radio broadcaster immediately upon being received by teletype. He broadcasts them to all patrolmen in radio-equipped patrol cars, and in this manner the force is kept informed of all police news of general interest.

The radio station has an emergency power unit. This is necessary because the radio has become an essential part of the communication system. However, in anticipation of the transmitter's being shut down for emergency repairs at some time, all the radio patrol cars in the various districts are required to call their divisional station at a stipulated time each hour. By this method, the division has an automobile at its disposal at least every fifteen minutes. Were radio communication interrupted, the calls received at the central complaint switchboard would be relayed to the divisions by telephone or teletype and transmitted to the patrolmen in the districts when they make their hourly telephone calls to their respective division headquarters.

A light delivery automobile has been equipped with a radio and all the necessary parts and testing devices for servicing

Form 391 LOS ANGELES POLICE DEPARTMENT

EMERGENCY REPORT

Date....., 193.....

Time:.....m.

Broadcast No.....

Location.....Name of Victim.....

No. of Bandits..... Name of Concern.....

CAR USED: YES ☐ No ☐ Make:.....Unknown ☐ License.....Unknown ☐

Type..... Color..... Remarks.....

Direction Bandit(s) Went.....

DESCRIPTION

(1) Nativity and Smooth Shaven ☐
Complexion..... Age..... Ht..... Wt..... Hair..... Eyes.....
Mustache ☐
Bareheaded ☐ .....Days' Growth
Hat ☐ Cap ☐ O'Coat ☐ Suit Coat Pants
Color..... Color..... Color..... Color..... Color.....

Gun.....B.S. ☐ N.P. ☐ Automatic ☐ Revolver ☐ Caliber.....

(2) Nativity and Smooth Shaven ☐
Complexion..... Age..... Ht..... Wt..... Hair..... Eyes.....
Mustache ☐
Bareheaded ☐ .....Days' Growth
Hat ☐ Cap ☐ O'Coat ☐ Suit Coat Pants
Color..... Color..... Color..... Color..... Color.....

Gun.....B.S. ☐ N.P. ☐ Automatic ☐ Revolver ☐ Caliber.....

(3) Nativity and Smooth Shaven ☐
Complexion..... Age..... Ht..... Wt..... Hair..... Eyes.....
Mustache ☐
Bareheaded ☐ .....Days' Growth
Hat ☐ Cap ☐ O'Coat ☐ Suit Coat Pants
Color..... Color..... Color..... Color..... Color.....

Gun.....B.S. ☐ N.P. ☐ Automatic ☐ Revolver ☐ Caliber.....

Amount Secured $.....

Telephone: (Business)..... (Residence).....

Home Address: .....
(If held up on street)

REMARKS: .....

Broadcast to:	Teletyped to:	Telephoned to:	Dispatcher:

radio receiving sets. When the patrolmen in any automobile have radio trouble, they call the complaint switchboard and the service man is notified by radio to go immediately to the district calling and take the action necessary to put the equipment back in use.

Service men are required, at the termination of each tour of duty, to give the Communication Division a record of batteries and tubes replaced and of all repairs made. This information is tabulated in order to show the exact annual expense of maintaining each receiving set in use and thus provide data upon which to base the budget request for the next succeeding year.

THE TELETYPEWRITER SYSTEM

The present police teletypewriter system is composed of 42 machines as follows: 38 Model 12 Morkrum-Kleinschmidt page printers, 2 Teletypewriter Corporation Model 14 tape printers, and 2 Model 12 Morkrum-Kleinschmidt (Bell System) page printers. Thirty-eight of these machines are owned and maintained by the city, and represent an investment of approximately $95,000. The distribution of the 38 city-owned and the 4 privately-owned machines is as follows:

28 sending and receiving machines, two in each of 13 divisions, and two at the Central Record Division.

3 combination sending and receiving machines, Electrician's Shop, City Hall.

2 receiving-only machines, one at Wilmington and one at North Hollywood, these points being teletypewriter substations.

2 broadcasting machines, Communication Division of Police Department, City Hall.

2 intercommunicating machines at Communication Division.

2 intercommunicating machines for state-wide system, Communication Division at City Hall, leased by the State of California from the Bell Telephone Company and used for state-wide communication purposes, being connected with 18 cities and strategic border points in California, in addition to a connection to Reno, Nevada.

2 tape printers, Communication Division, City Hall; one is owned by the Western Union Telegraph Company, and the other by the Postal Telegraph Company, both machines being used for sending or receiving commercial telegraph messages.

1 intercommunicating machine at Communication Division, City Hall, connected with the Sheriff's Department and his nine substations in Los Angeles County.

As noted in the list, the nine machines last mentioned are placed at present in spaced position in the Communication Division of the Police Department. Through this departmental system, consisting of two broadcasting and two intercommunicating machines, two switchboards, a meter board, and two generators (one to furnish direct current, the other as an auxiliary), it is possible to contact by all machines a total of forty-eight points. A few examples of the system's flexibility are brought out below:

Four divisions can intercommunicate simultaneously while a fifth is sending in a report for broadcasting or other purposes, and at the same time a general teletyped broadcast can be dispatched by the police teletype operator to all police divisions and substations.

Four divisions can transmit reports to Police Headquarters simultaneously, two on the intercommunicating machines and two on the broadcasting machines, the latter being converted into receiving machines by the use of monitor cord plugs.

Messages can be acknowledged in writing, or by means of a flashback arrangement on the intercommunicating switchboard.

Generators can be changed over, line trouble traced, and voltage increased or decreased by manipulation of switches, cam keys, and rheostats on the meter board.

Individual line readings for voltage and amperage can be taken and fuses replaced on both switchboards, thus reducing trouble calls for the repairman to a minimum.

The state-wide intercommunicating teletypewriters are in operation 16 hours daily, each machine running about 8 hours a day. Over these machines are received and dispatched the messages, destined to any one point or to all points, formerly handled by telegraph, telephone, or air mail. Answers to messages sent to the State Capitol at Sacramento, regarding motor-vehicle registration data, and so on, have been received in from three to ten minutes. On occasion, other points have answered messages immediately.

Outgoing state teletype messages originate either at Police Headquarters or at a police divisional station. If at headquar-

ters, the detail handling them prepares the message in septuplicate and delivers the seven copies to the Business Office for approval. After receiving this approval, the seven copies are sent to the teletypewriter room for dispatching. As soon as the operator receives it he gives it a number, contacts the destination point, and dispatches the message. Two copies of the numbered message are returned to the detail handling the matter and three to the Business Office, one copy is forwarded to the Record Division, and the remaining copy is filed in the teletype room.

If the message originates at one of the territorial Divisions, it is teletyped to the Communication Division. A messenger takes it to the Business Office, where seven copies are prepared and the routine just described is followed.

The teletype machines in the Communication Division are equipped with "ditto" or duplicating ribbons. Upon receipt of an incoming state-wide message which is in answer to a message sent by the Department, eight copies are made on the "ditto" machine and all are delivered to the Business Office, where they are stamped with the time, date, and police unit which the message concerns. Three of the copies are given to the messenger for delivery to the bureau or detail waiting for the answer, two of these are kept by such bureau or detail, and the third, bearing the signature of the detail commander, is returned to the Business Office. A fourth copy is returned from the Business Office to the teletype room, this copy bearing signed acknowledgment of its receipt. After clearing the incoming message file in the teletype room, this copy is forwarded to the Record Division.

Upon receipt of incoming state-wide messages addressed to "All Points," the messages are edited, and if they do not contain specific matter calling for assignment, they are given a broadcast number and immediately dispatched over the Department's teletype system. A copy is given to the Radio Room for broadcast to radio patrol automobiles. Copies made on the "ditto" machine are distributed to all quarters' bureaus. Frequently, all persons concerned are in receipt of an

"All Points Bulletin" five minutes after its reception in the teletype room.

Simplex tape printers.—All Police Department telegrams, incoming and outgoing, are handled on the tape printers. These printers have been installed by the Western Union and Postal Telegraph companies and are connected with their respective main offices. All outgoing telegrams are prepared by the police branch handling the matter and are sent to the Business Office for approval and recording. The approved copy is delivered to the teletype room for dispatching.

Recently the telegraph companies have begun a "timed wire service," through which it is possible to contact, over the tape printers, police departments throughout the United States and dispatch messages to them direct. This is only a one-way service, however; its chief advantage is a saving in the cost of very lengthy telegrams.

Accessory telephones.—By means of a locking device, calls involving major crimes received on the complaint switchboard are heard simultaneously by the Business Office, the Homicide and Robbery Bureaus, and the teletype room. While the complaint-board operator is asking for and recording on Form 392 or 391 (see pp. 364 and 373) all pertinent information necessary in order to dispatch the radio patrol automobiles, these offices listen in and take such action as comes within their respective spheres. The teletype operator, also listening in, records the call on Form 392 or 391, and dispatches it over the teletype system to all concerned.

The apparatus in the teletype room that is used for such calls consists of a telephone headpiece, an automatic gong, and an amplifying device, all installed by the telephone company. The amplifier controls the tone and volume of the complainant's voice, and by manipulation of a control dial the voice may be regulated from "ordinary" to "loud" or any intervening gradation.

All messages dispatched over the interdepartmental teletype system are received in written form from headquarters bureaus, the complaint switchboard, or one of the fifteen ter-

ritorial divisions, by way of the intercommunicating machine. Exceptions to this rule include calls received through the complaint switchboard or the City Hall central switchboard concerning missing juveniles or adults, together with emergency case reports and the supplements thereto. Frequently, radio patrolmen who have responded to an emergency call are able to supplement the original report with additional information after further interrogating the complainant. They telephone the teletype operator direct and dictate the additional information, which is promptly teletyped as a supplement to the original broadcast.

Miscellaneous items.—The interdepartmental broadcasting teletypewriters are equipped with rolls of duplicating teletype paper, and the duplicate copy of every message broadcast is given to the radio operator, who broadcasts or files the message, depending upon the nature of its contents. The original message is run on the "ditto" machine, a sufficient number of copies being made to ensure proper distribution to all concerned.

At present only about one-fifth of the messages numbered by the Division of Records are obtained over the teletype system. Additional equipment has been purchased and soon will be installed. It is then planned to handle all the numbers of the Division of Records by teletype, the object being to eliminate the many errors occurring as a result of transmitting messages over telephones. All booking of arrested persons is handled by teletype, the arresting Division contacting the Central Booking Office over teletype lines, giving the booking number, name of person arrested, age, descent, offense, time and location of arrest, and the name and number of the officer making the arrest. Subpoenas and warrant recalls are dispatched by teletype.

Two additional sets of relays and two intercommunicating machines are to be installed soon in the teletype room to provide greater flexibility, eliminate delay, and teletype all Divisional record reports.

Adjacent cities, such as Santa Monica, Culver City, Bev-

erly Hills, Glendale, and others, are now receiving the benefit of the Los Angeles police radio broadcasting facilities. Some of these cities already have appropriated money for the installation of teletypewriters, but have not decided whether to connect with the Sheriff's Office or with the Police Department. Inasmuch as their radio patrol cars will be dispatched by the Los Angeles Police Department radio operator, it seems logical that they should be wired to the Police Department system, and, as in other cities, teletype their dispatch requests instead of telephoning them. If this connection is made, duplicate teletype rolls would be used, and after an outside dispatch was received, it would be a matter of only a few seconds until the original copy was delivered to the radio operator for dispatching.

THE BEAT COMMUNICATION SYSTEM

Each of the fifteen territorial Police Divisions in Los Angeles is equipped with its own police station and complete police signal and telephone system. It is at this point that communication facilities are first decentralized. Each of the signal and telephone systems, except as noted below, consists of the station reception and dispatching equipment, boxes, and the necessary overhead and underground lines.

The police station equipment consists of a motor generator set (110-volt alternating current; 75-volt direct current), with a 48-volt storage battery floating on the generator, a charging and distributing switchboard, a desk with a private branch exchange, a register, and a reel. Police telephone boxes, of which there are 500, consist of an outer shell of cast iron or aluminum alloy, with an inner door of like material recessed to hold a Western Electric No. 1001-A hand set with grounded frame on a switch hook. On the inside of the inner door is a plain make-and-break signal mechanism, adjusted for one-pull telephone hook-switch, ringer, door-operated switch, and the necessary terminal blocks, condensers, induction coil, and other associated equipment.

All overhead lines consist of two No. 12 hard-drawn, triple-braid, weatherproof copper conductors carried on standard

crossarms on the poles of the various public utilities wherever possible, and suitably transposed. Underground lines consist of a pair of No. 19 conductors in lead-covered, paper-insulated, filled cables in telephone company ducts. The junction of underground to overhead lines is made through vacuum-type lightning arresters and the Western Union type 2500-volt, 5-ampere fuses. The lines enter Police Division stations in a cable in an underground conduit and terminate on Cook terminals with 3-ampere, 2000-volt fuses, heat coils, and carbon-block lightning arresters.

Street telephone boxes are placed at the intersection of the boundary lines of the patrol beats. When the boxes are on boundary lines between two or more Divisions, they are equipped with a rotary switch, the manipulation of which connects the box with the Division to which the patrolman wishes to report. These boxes are ordinarily used in the following manner. Each patrolman reports from a box every hour by opening the box and pulling a lever which causes the recording of the box number at the telephone switchboard of his Division and indicates that someone is calling from that box. The patrolman gives his name and the box number to the Divisional operator, and if there are instructions for him, the operator gives them at this time. If there are no instructions, the patrolman replaces the hand set and the operator causes the bell in the box to ring twice to indicate that the report has been received.

The beat telephone system is used by patrolmen in making reports to their Division about the disposition of cases assigned to them by radio broadcasts to patrol cars. The Divisional operator in turn reports to the disposition clerk at the Communication Division in Central Headquarters. It is absolutely essential that the Communication Division receive the disposition report, for otherwise it would have no knowledge that the call had been answered. The disposition report also serves the purpose of showing that the automobile reporting is available for further service.

THE ALARM SYSTEM

The O. B. McClintock Company, of Minneapolis, Minn., has installed and maintains a Police Call Annunciator Alarm System in the complaint switchboard room of the Los Angeles Police Department. The system is designed primarily for the use of banks and large mercantile establishments as a means of protection against criminal attack. A small fee is paid by the subscriber to the McClintock Company for installation and maintenance, and the connecting wires employed are leased from the telephone company at a nominal cost.

The McClintock Company's experts install and maintain the equipment in proper working condition both at the Police Department and at the subscriber's business location. The subscriber has means of testing the condition of the connecting wires without operating his unit of the system at the central switchboard, and if outgoing wires are tampered with he is notified immediately by the local trouble bell. The subscriber's equipment consists of the control cabinet and the signaling stations. Alarm-exciting devices used are the McClintock pinch-type holdup buttons, the mercury-ring foot-rail, and other cleverly designed devices placed at strategic points in the subscriber's place of business, so that in the event of robbery or other trouble he may signal the Police Department with very little effort. If the subscriber is equipped with a local burglar alarm, arrangement is made for its connection to the silent alarm system and it is wired direct to Headquarters.

Operators are on duty twenty-four hours a day at the complaint switchboard at Central Headquarters, and on receiving a signal from the Police Call Annunciator, broadcast it by radio to the patrol cars. In addition, signals received are also transmitted to the flying squadron of the Detective Bureau of the Central Division, or to the emergency automobiles of other Divisions. This ensures that the call is answered.

The numbers on the McClintock Police Call Annunciator form an index to the locations of the subscribers, a list of

which is kept for reference under a glass on the complaint switchboard. This index also shows the radio patrol car assigned to a district containing a specific address, which eliminates the necessity of referring to the city-wide index. In the regular course of business, an alarm coming in over the McClintock system would be relayed to a car in the vicinity of the premises attacked within about 10 seconds after its reception.

THE POLICE COMMUNICATION SYSTEM: BERKELEY

GEOGRAPHICAL AND TOPOGRAPHICAL FACTORS

Berkeley, California, is a city of 86,000 people situated on the eastern shore of San Francisco Bay. It is but one of many cities in the populous East Bay metropolitan area, which extends over the two counties of Alameda and Contra Costa. The police problem of the city of Berkeley is not an individual one, for on the south the boundary of the city coincides with that of the cities of Oakland, Calif. (300,000 population) and Emeryville (2,400 population), and on the north, Berkeley merges into the smaller cities of Albany and El Cerrito. So closely are the cities of the East Bay area nested together that their boundaries are merely political, and a stranger would be unable to determine when he left one city and entered another. Moreover, the whole metropolitan area is tied together by a highly developed system of lateral and arterial highways, many of the main thoroughfares passing through from six to ten adjacent communities. It is thus apparent that reciprocal responsibility in public-safety affairs is vested to an unusual degree in all the municipal and governmental agencies in this area.

The topography of the eastern shore of San Francisco Bay is such that the police, aided by adequate communication, have an excellent opportunity to apprehend escaping criminals. The greater part of the population lives on a narrow plain between the Bay and the hills to the east. From this area, the avenues of escape are relatively few and can be easily closed by the various patrol forces if they are notified

quickly of this necessity. To the west, escape is possible only by means of ferries, and more recently by bridges, all of which can be placed under surveillance without delay. To the north and south there are a few major exits, and only two main highways with minor laterals penetrate the eastern hills. Thus the effective police blockade of the entire area in criminal emergencies depends almost entirely upon the speed with which the police forces in the jurisdictions concerned can function.

GENERAL COMMUNICATION FACILITIES

The police communication system of Berkeley is composed of four major separate units, which combine to form a single, well-balanced operating whole, with all communication activities centralized at Police Headquarters. These units are: (1) the police telephone system; (2) the patrol recall system; (3) the patrol radio communication system; and (4) a silent alarm system for banks and large mercantile establishments. A fifth unit is the general-alarm siren, and a proposed installation will include sending and receiving equipment to connect with the state-wide teletypewriter system.

THE POLICE TELEPHONE SYSTEM

Prior to 1925, the police telephone system consisted of fifty-seven beat stations installed at various places in the city and connected to a central switchboard at headquarters. In its stead, a contract was entered into with the telephone company for the installation of a complete individual telephone system, consisting of a modern telephone exchange board with a capacity of 120 circuits at Police Headquarters, and independent beat telephone units connected with the police exchange by individual pairs of wires routed through the cables of the telephone company. The system thus became one in which a large number of individual telephone stations were brought under the direct control of the Police Department. Similar in all respects to the commercial telephone unit, they did not require commercial exchange service, since they were wired directly to the new police switchboard. An important condi-

tion of the contract was that the system would be maintained by the telephone company, which, with its corps of trained telephone experts, was in a position to provide a superior service. All telephone equipment is leased by the Police Department from the local telephone company on a rental basis.

The new telephone installation comprised the following equipment: (1) a private branch telephone exchange at headquarters; (2) sixty-five beat telephone units appropriately housed and installed at strategic points throughout the city; (3) independent transmission lines connecting each unit with the police exchange; and (4) office-intercommunicating lines and equipment and direct leased-wire connections with outside departments in the immediate area.

The hub of the system is the new switchboard at police headquarters, which is connected not only with each beat telephone unit, but also with all outside local, county, and state telephones, through eleven trunk lines leading to the telephone company's general exchange. Private leased wires connect the police switchboard direct to police headquarters in eight other cities on the east shore, in addition to the sheriffs' offices of Alameda and Contra Costa counties, and the office of the District Attorney of Alameda County. Further, all interoffice telephone communication between the various divisions and bureaus at headquarters passes through this exchange board, which also accommodates a direct connection with the City Hall telephone exchange. A desk sergeant is in attendance at the police switchboard constantly at all hours of the day and night.

Two telephones are provided at headquarters to serve the needs of those officers who may be engaged in confidential investigations. These units are wired directly to the city exchange of the telephone company and do not pass through the local switchboard.

Since all beat and interoffice telephones are independently wired to the police switchboard, each pair of arriving wires terminates in a jack, with which is associated a small pilot light and connection to a common buzzer. Thus, an incoming

call over either the beat or interoffice telephone system results in both audible and visual signals, which ensures prompt response at the switchboard. Each jack and pilot light is carefully labeled, affording a convenient and accurate index by which the desk sergeant may, for instance, immediately determine the number and location of the box over which a call originates.

Beat patrolmen are required to report in to the desk sergeant over a telephone at hourly intervals, at which time the officer receives any instructions that may be pending, and the sergeant records the time of the call on a time-sheet form provided for the purpose. Beat officers are also required to report any interruptions in normal patrol work, such as time out for lunch, investigations, and other activities which may temporarily cause them to be unavailable. Notations concerning these irregularities are made on the time sheet in order that the sergeant in charge may have before him at all times an accurate picture of the location and distribution of patrol strength available to him for assignment.

The reporting time of beat officers is staggered, which relieves congestion at the police switchboard. A result of this arrangement is that, through the system alone, headquarters is in touch with one or more members of the dispersed patrol force at very short intervals.

Through the eleven trunk lines leading to the main telephone exchange, adequate facilities are provided for rapid telephone contact with the community at large, and with the outside world. There is but one police headquarters and, so far as the general public is concerned, but one police telephone number. All complaints, reports, and requests for police assistance arrive over telephone lines at the police switchboard, or they may be delivered personally to the desk sergeant at headquarters. The greater number of such reports are received over the telephone. In any case, the desk sergeant is the complaint dispatcher and he immediately routes the report or information to the division, bureau, detail, or patrolman concerned.

The advantages of this telephone system are apparent. Any outside citizen may communicate with any particular division or official in the department through the single exchange board, and the officers at headquarters and the patrolmen on the street may get in touch with any particular person within or outside the department through the same exchange. To talk to any person within the city or hundreds of miles away, the patrolman at the box needs only to lift the receiver and ask for a connection with the main telephone exchange.

THE POLICE RECALL SYSTEM

The present system of signaling to policemen on duty throughout the city by means of electric lamps, a system installed in 1925, was designed by Frank B. Rae, then City Electrician of Berkeley. The new signaling system consists of the central office control unit, forty-one red lamps hung over the center of strategic street intersections and the necessary connecting wires and circuits. The red-light signal units are distributed in four loop circuits which together blanket the entire city. By a new method of wiring, a single relay of special design controls all the lamps on any one circuit, so that but four such relays are necessary to operate the system. From ten to fifteen light units are placed on each circuit, and relay circuits are operated from the 110-volt distribution circuit of the light and power utility, thus dispensing with the need for storage batteries.

The red-light units are modern Mazda lamps of 200 watts, enclosed in General Electric Novalux street-lighting fixtures, in which a Holophane ruby bowl four-way refractor takes the place of the usual white globe of the ordinary bowl. The ruby light is clearly visible in the sunlight for a distance of from 2000 to 2500 feet, as compared with from 300 to 500 feet for the carbon-lamp red-globe combination previously used. The number of these units is being increased each year in accordance with a well-devised improvement and extension plan.

At the central office, the control box of the signaling system adjoins the police switchboard, so that it can be conveniently

operated by the desk sergeant. The front panel of the control box is equipped with four rows of tumbler switches, each row representing one of the four circuits of the system, and each switch controlling an individual combination. There is assigned to each officer on the force a signal to which he must respond, and he disregards all other signals which may be flashing over his circuit, except the general alarm signal.

Circuit signaling is effected by a set of code wheels driven by a motor situated behind the panel of the control box. The code wheels are so arranged that, by manipulation of the switches on the control panel, the following can be accomplished: (1) any code-signal wheel may transmit its signal upon any single circuit, or simultaneously upon any number of circuits; (2) different code-signal wheels may transmit signals on separate circuits; (3) the light-signal units may be caused to burn continuously on one or several circuits, and, simultaneously, code signals may be sent on any or all of the other circuits. In operation, a pilot lamp in each of the relay circuits flashes the signal that is being transmitted, or it will show a constant light on any circuit that is set to show a continuous light on the signal units. These pilot lamps also indicate that the relay controlling the lamp is performing properly.

With the intense and compelling power of the 200-watt lamp unit and ruby refractor employed, it was considered unnecessary to install an audible signal to attract the attention of a patrolman; a horn or bell could, however, be installed with every light if this should be deemed advisable.

If the desk sergeant wishes to get in touch with a certain patrolman in District No. 1, he flashes his beat number over Circuit No. 1, until the patrolman calls headquarters from the nearest police box in response to the signal. If this patrolman's beat lies on the boundary of two circuits, say Circuits Nos. 1 and 2, the desk sergeant may operate the signal on Nos. 1 and 2, thus making doubly sure that the patrolman will respond to the signal. Likewise, if the beat should cover three or four circuits, the officer's signal could be sent on each

or all of them. While this officer's signal is flashing on one or more circuits, another signal may be sent simultaneously over any of the other circuits.

Perhaps the sergeant wishes to get in touch with all the men on a circuit. By a switch on the panel, he can make all the lights on the desired circuit burn steadily, which is the general-alarm signal to which all the men on that circuit will report. While the lights are burning steadily on this circuit, the other circuits are free for sending any desired signal over any or all of them. Similarly, the men on the other circuits can be summoned in emergencies by burning the lights steadily on the desired circuits. Following an emergency call, if it is desired to recall all the men, or to transmit additional information, a signal for that particular purpose may be sent.

In this manner, the desk sergeant can communicate with any individual patrolman on the street, or with any group of patrolmen, or with every officer on duty at that time. From tests made on many occasions, it has been determined that the entire police force can be reached in from three to nine minutes. Very often, contact is made with individual members of it in less than one minute.

THE POLICE RADIO SYSTEM

The Berkeley Police Department was peculiarly fitted for the pioneer work of applying radio to police work. In the first place, the entire police force of Berkeley had been completely motorized since 1914, each officer supplying his own car, for which he received a liberal monthly maintenance allowance from the city. Secondly, the city of Berkeley, being centrally located in the East Bay metropolitan area, was in a favorable position for undertaking to supply this entire area with police radio service.

Contracts[1] were therefore entered into with all the cities in the two counties of Alameda and Contra Costa, and with the sheriffs and district attorneys of these counties, whereby Berkeley undertook to broadcast radio information to all

[1] See Appendix 2, p. 489.

these units through its radio transmitter. Thus the Berkeley radio communication system serves as a message-transmitting agency for all police officials within a radius of fifty miles and over a combined area in excess of 1440 square miles.

The police radio equipment consists of:—(1) a 400-watt radio transmitter, (2) thirty-five receiving sets installed in police cars of the Berkeley Police Department, in addition to receivers installed in the police cars of other municipal or county agencies served by the system, (3) remote-control apparatus at the police switchboard, and (4) a radio service shop and organization.

The Berkeley transmitter, housed in a building north of the City Hall, is a radio-telephone transmitter of the master-oscillator power-amplifier type. The radio carrier frequency is generated in a power quartz piezo-electric oscillating circuit, and the stability of the quartz plate is ensured by an automatic control of its temperature to within .01 degree Centigrade. The frequency generated in this circuit is amplified through succeeding radio-frequency stages of increasing power until a final stage is reached which has a carrier output of approximately 400 watts.

Modulation is applied to the final radio-frequency amplifier, and the system employed is a modification of the conventional plate or Heising method. Voice is applied to the circuit through a microphone and two-stage speech amplifiers which excite two 49-type tubes. The operating frequency of the transmitter is 2618 kilocycles. Service tests showed that this transmitter sent satisfactory messages, not only to every point in the two counties it serves, but to many points over a wider area besides.

The receiver necessary to ensure satisfactory reception in an automobile must be very high grade, sensitive, and kept in good condition. To answer these requirements and that of compactness, each of Berkeley's radio-equipped police cars contains a specially designed 7-tube superheterodyne set, measuring 8½ inches in height and 9 by 9 inches in base dimensions. The entire power supply is taken from the stor-

age battery of the car, thus eliminating all "B" batteries. These receivers are so well built that some of them have gone as long as five months without any attention or repairs. Receivers are connected to a magnetic type loud-speaker which is installed in the top of the car, not more than twenty-four inches from the officer's head. This ensures clear and audible reception of messages at all times.

Messages are broadcast over remote-control lines from a microphone suspended in front of the desk sergeant. By throwing a switch, conveniently located, the transmitter is immediately ready for broadcast. Not only are local messages sent, but also all messages originating in any of the cities and offices served by the system are transmitted in this manner.

A police official outside of Berkeley who is served by this facility lifts a telephone receiver and is at once in contact with the desk sergeant at Berkeley police headquarters through a private leased wire. Thus all delay incident to routing a call through the city telephone exchange is obviated. The reception of a call and its broadcast are simultaneous. For example, Northern Police Station (Oakland) calls Berkeley and the desk sergeant answers the telephone. The person calling says, "Broadcast from Northern Station." Desk sergeant says, "Just a moment," and opens the microphone; then says, "Which car?" Northern Station replies, "Cruiser No. Blank"; desk sergeant repeats, "Cruiser No. Blank" into the telephone and microphone at the same time. Northern Station says, "2241 Blank Street"; desk sergeant repeats, "2241 Blank Street"; Northern Station says, "A holdup in progress"; desk sergeant repeats, "A holdup in progress." Northern Station says, "That is all," and hangs up. At the time the Northern Station officer replaces the telephone receiver on the hook, the Oakland radio-patrol car is in possession of the complete broadcast and on its way to the destination. The Berkeley desk sergeant then speaks into the microphone again, repeats the entire message twice, and ends with, "Transmission No. Blank; that is all, K-S-W." Messages intended for a specific car serve to notify officers in all police cars patrolling

throughout the entire area, thus keeping them alert, and enabling them to act with greater intelligence and certainty in unexpected encounters with criminals.

Broadcast reports of cars stolen in San Francisco (a city of 637,212 population, in 1930, at a distance of six miles across the Bay from Berkeley and Oakland) to police cars in that city are copied in Berkeley, and immediately re-broadcast over the entire East Bay area. Likewise, reports of cars stolen in the East Bay cities are copied by San Francisco and transmitted to their radio-equipped cars.

Stationary police receivers are being installed throughout the East Bay district at strategic points, such as bridges, ferries, and similar control points through which all persons leaving the area must pass. Installation of radio receivers is now in progress on the numerous automobile ferryboats which ply regularly between Berkeley and San Francisco. Descriptions and license numbers of cars will be received by members of the crew and an effort made to locate stolen cars while they are in transit. This extension of police radio-communication service is but preliminary to the final installation of receiving equipment on all passenger and automobile ferries in operation on San Francisco Bay. The completion of Golden Gate Bridge and another similar structure connecting San Francisco with the East Bay area create additional points of surveillance which the police may use advantageously in the interception of the lawbreaker. In the event of the commission of a major crime, the invisible communication network will enable law-enforcement officials to close the area and barricade every avenue of escape for the criminals. If they are not caught red-handed, pursuit will have begun while the trail is still hot, and the search may be restricted within comparatively narrow limits.

THE SILENT ALARM SYSTEM

The fourth unit of the communication system is the silent-alarm network, which connects banks and other business establishments caring for large sums of money or valuables to

police headquarters over leased wires. By tripping a lever, pulling open a drawer, or by any one of a number of other devices, an alarm may be sent to the police switchboard from any of the buildings so protected.

At headquarters, adjoining the police switchboard, is the secret alarm board, into which all such private leased wires run. A separate board is made necessary by the telephone company's rule against placing in its switchboard equipment any wires for which it is not responsible. Were this regulation not in force, alarm transmission lines would be routed directly to the PBX panel. When an alarm is turned in, either by accident or by design, a red light appears over a number on the panel, which indicates the point from which the alarm is originating, thus providing a convenient index to the various protected premises. At the same time, a buzzer is automatically placed in operation and continues to sound until officials from the Police Department reach the place from which the alarm is sent. Following are the general features of the system's design and installation.

(1) Wires connecting banks and other establishments directly with the police department, these connecting circuits being so disposed that they cannot be tampered with.

(2) A signaling device at police headquarters adapted to produce both an audible and a visual signal, both such signals persisting until they are reset by the officer on duty, thereby ensuring signal reception.

(3) Any interference with the bank equipment or the connecting wires to cause an open circuit, or a short circuit, or a ground, or in any way disturbing the adjusted balance of the system, operates the alarm signal.

(4) Each connecting circuit and its equipment, both at the bank and at police headquarters, is under constant electrical supervision, so that a failure of any part of the system will be automatically indicated.

In this manner the premises connected into the silent alarm system are given the extra protection which the business conducted in them makes necessary.

To illustrate how these four major units are blended into one coördinated communication system, consider, for example, the receipt of such a message over the secret alarm system. Immediately, the recall-light signals are flashed in that district, and an alarm gong at headquarters is rung, notifying every person on duty there that an emergency alarm has been received. The radio transmission unit is put in operation and the radio cars needed to take care of the alarm are immediately dispatched to the scene of action. Should the officers in these cars need further information, they go to the nearest telephone. Plans are being drawn up for the use of portable transmitters in patrol cars for two-way radio communication, which will eliminate any delay incident to using a telephone in such emergencies.

Meanwhile, officers observing the emergency recall signal in action have called in and received their instructions. Thus the desk sergeant, who receives all requests for police assistance, controls every means of communication at the disposal of the department and can command the whole force from his central position.

An important but little used unit in the communication system is the general-alarm siren, which is installed on the roof of a very tall building in the geographical center of the city. In emergencies or catastrophes requiring a general alarm, this siren, actuated either from the central fire-alarm station or the Fire Chief's office, is sounded. All officers, on or off duty, are required to respond to this signal immediately, either in person or by telephone. Direct wires, of course, extend from the police switchboard to the fire-alarm room.

Arrangements are now being made to connect the Berkeley Police Headquarters with the state-wide teletypewriter network, the central control point of which is in the Division of Criminal Identification and Investigation, at the State Capitol, in Sacramento, Calif. Messages received at that Division are sent out over the teletypewriter system to all police departments and sheriffs' offices in the state which are connected in the network. At present, Berkeley has such a connection

secondarily through direct telephone contact with the Sheriff's Office in Oakland. Messages of special importance to East Bay officers are broadcast over the police radio. When the teletypewriter is installed in Berkeley, it will be possible to receive and transmit messages directly to and from any part of California, as well as to the city of Reno, Nev.

A PLAN FOR THE SMALL COMMUNITY

The discussion is here concerned with the small communities of population not exceeding 10,000 which dot the map of this country and which, for the most part, are defenseless against criminal raid. Some idea of the extent and distribution of these small centers of population may be gained by a glance at the accompanying tables (pp. 395, 396), prepared from the 1930 census reports.

The combined total population of this group of small communities is in excess of 19,798,199 or approximately 16.1 per cent of the total population of the entire United States. Yet, despite these imposing figures, little or no thought has been given to the development and use of even ordinary facilities of communication to reduce the hazard presented in these comparatively unprotected localities. An attempt is here made to present a simple, inexpensive plan of police communication which will afford the same type of protection that is found in the departments of larger cities. In every community, occasions arise in the course of normal activity when calls for police assistance are made. It is to the distinct advantage of both the community and the authorized police agency that some means be quickly available to inform the police that they are wanted. The existence of an open channel of communication between members of the community and the police agency is a fundamental requirement of police service, regardless of the size or population of the town or city.

Prompt service in taking care of ordinary complaints will impress local troublemakers and reduce, if not eliminate, many sources of amateur criminal activity which, if not retarded, may later develop to serious proportions. In emergen-

DISTRIBUTION OF SMALL COMMUNITIES IN THE UNITED STATES

State	Number of cities 5,000-10,000	Number of cities 2,500-5,000	Number of cities 1,000-2,500	Number of cities Under 1,000
Alabama	11	28	64	179
Arizona	6	6	9	11
Arkansas	9	31	58	282
California	48	58	77	48
Colorado	10	9	42	172
Connecticut	5	4	7	5
Delaware	0	4	11	36
Florida	17	27	52	179
Georgia	16	33	91	438
Idaho	5	14	22	107
Illinois	56	78	211	726
Indiana	27	34	97	331
Iowa	14	46	123	713
Kansas	12	30	85	433
Kentucky	16	24	74	242
Louisiana	11	29	53	109
Maine	9	8	8	14
Maryland	3	12	26	90
Massachusetts	..	..	..	...
Michigan	32	42	111	250
Minnesota	18	41	93	562
Mississippi	4	22	55	219
Missouri	21	35	116	585
Montana	6	6	24	74
Nebraska	9	18	73	421
Nevada	1	3	5	6
New Hampshire	2	..	..	...
New Jersey	50	53	85	86
New Mexico	4	9	11	29
New York	41	85	146	254
North Carolina	17	30	91	339
North Dakota	6	2	29	285
Ohio	51	63	160	528
Oklahoma	22	30	99	345
Oregon	9	13	29	147
Pennsylvania	103	149	216	425
Rhode Island	..	..	..	...
South Carolina	12	19	54	171
South Dakota	2	8	41	242
Tennessee	14	26	49	136
Texas	47	76	190	231
Utah	4	14	34	88
Vermont	7	4	20	41
Virginia	10	19	42	128
Washington	4	19	42	141
West Virginia	12	17	62	107
Wisconsin	20	36	87	332
Wyoming	3	3	17	59
Total	806	1,317	3,087*	10,346
Grand total				15,556 communities†

* Total does not accomodate result of counting four places in two states each.

† Tabulations include only incorporated communities. The census reports indicate that Massachusetts and Rhode Island had no incorporated towns within these population classifications, while New Hampshire had only two in the 5,000 to 10,000 classification.

cies, such communication facilities may mean the difference between the life or death of some individual in the community, or the determining factor in the apprehension of a lawbreaker who would otherwise have made a successful escape.

With a higher degree of police protection in the large metropolitan centers, it was to be expected that criminals would

DISTRIBUTION OF SMALL COMMUNITIES IN THE UNITED STATES BY REGIONAL DIVISIONS

Regional division	5,000 to 10,000	2,500 to 5,000	1,000 to 2,500	Under 1,000
New England	23	16	35	60
Middle Atlantic	194	287	447	765
East North Central	186	253	665	2,167
West North Central	82	180	560	3,241
South Atlantic	87	161	428	1,488
East South Central	45	100	242	776
West South Central	89	166	398	967
Mountain	39	64	164	546
Pacific	61	90	148	336
Total	806	1,317	3,087	10,346

States comprising each regional division are as follows:

New England.....Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut.
Middle Atlantic.....New York, New Jersey, Pennsylvania.
East North Central.....Ohio, Indiana, Illinois, Michigan, Wisconsin.
West North Central....Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas.
South Atlantic.....Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida.
East South Central.....Kentucky, Tennessee, Alabama, Mississippi.
West South Central....Arkansas, Louisiana, Oklahoma, Texas.
Mountain.....Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada.
Pacific.....Washington, Oregon, California.

shift the scene of their activities to the smaller towns and communities where the hazards of apprehension were not so great. The entry of the outside criminal into towns and villages means a troubled period for a group of peaceful and law-abiding people unless the criminal threat is checkmated with more effective equipment and methods. Driven from the larger cities, bandits and other professional criminals descend upon unwary rural communities which are known in advance to be unprotected and where the margin of safety substantially guarantees a successful escape from the scene

of crime. Statistics for the past ten years show an alarming increase in the number of bank robberies, murders, and other similar criminal attacks on the small community.

No longer may the rural locality consider itself isolated from the whirlpools of human activity to be found in the congested centers. Smooth macadam and concrete highways with their connecting laterals penetrate into every section, forming a gigantic transportation network which, with the automobile, has annihilated time and distance. Together, they make the small community accessible to sudden attack and supply the means for a rapid and successful escape. Time was when rural crime was largely confined to chicken stealing and similar minor offenses, conceived and executed by local miscreants. Crime in the rural districts and small towns today is far more likely to bear the trademark of some well-organized band of experts in outlawry, carefully engineered in the urban underworld, and carried out with the aid of all the instrumentalities provided by a machine age.

The lack of advance preparation and organization for emergency on the part of the community increases the hazards of the situation. The occurrence of a crime of even moderate proportions in the average small locality is therefore in the nature of a disaster or catastrophe.

A PLAN OF COMMUNICATION

In considering the police-communication possibilities in the small locality, cognizance is taken of the fact that financial resources are limited, as a rule, so that the investment in equipment must necessarily be small. The plan here presented requires but a nominal expenditure, well within the reach of any town or community, irrespective of size. It is a recognized fact that the smaller the police force, the more definitely will a communication system contribute to an increase in the value of the police department as a whole, and of each individual member of the force.

Police headquarters.—Two types of community are identifiable for purposes of this discussion: one has a regular po-

lice station or headquarters; the other has not. This is an important distinction, since any scheme of communication in police service requires the existence of a centralized point to which calls for police assistance may be directed, and from which the available force may receive its information and instructions. Where a police station or office is already established, this phase of the problem is automatically disposed of. Many small towns, however, do not feel that the volume of routine business justifies the expense involved in the establishment of a central office. Nevertheless, the first prerequisite of the communication plan is a definite central point for police operations. The police official may (and in many places he does) arrange with a local business firm for permission to use a small part of its office or premises as the centralized point in the local communication plan. It may be, too, that he uses his own home, if it is centrally situated, for this purpose.

The best and most logical expedient is to designate the local telephone office as police headquarters. Here, made to order, is the nucleus of a police communication system in the small community—a central office already established with direct lines of communication radiating to every section of the community and to the surrounding territory as well. Telephone companies will be found ready and willing to give all possible assistance.

Local telephone operators, usually young women, are conversant with every phase of the business and social life of the community, as well as the local geography, and they can render extremely valuable service to police officials. They are usually alert, and dependable in an emergency. Telephone history shows by many examples how they have remained at their posts, even at the risk of life, in dangerous situations.

The reporting-in schedule.—It is neither possible nor desirable for the local police official to remain at his headquarters, because, the police force being limited in numbers, every member of it is needed for patrolling the area served. The distribution of the entire force may be comparable to that

of a few police beats in a city. One of the first provisions of the plan, therefore, is that the force shall report in over the telephone to headquarters at stated intervals. This interval will depend upon local conditions, but should not exceed two hours. The maximum time interval covering the operations of the metropolitan beat officer is one hour. The local telephone operator should be provided with a simple record form on which she may record the time of these calls and make proper notations concerning the whereabouts of the officer or officers in the ensuing interval.

The reporting-in schedule increases the availability of the force and at the same time assures their receiving promptly any reports and information which may have arrived in the interim between calls. Even should the communication plan stop here, the community would be in possession of a definite communication framework which would amplify remarkably the power and effectiveness of its police. Up to this point, the plan does not involve the outlay of any money whatsoever.

Beat telephones.—It is not necessary that any funds be set aside for the purchase of field or beat telephones in communities of this class, particularly the smaller towns. As the population approaches the 10,000 mark, however, the need for such equipment begins to make itself felt, and the distribution of field telephones at strategic points will appreciably expedite police operations, serving the same purposes and functions as in the larger city. The cost of installing each field telephone should be little more than the cost of installing an ordinary house telephone extension. If they are attached to posts, or otherwise exposed to the elements, they should be protected by a locked, weatherproof housing constructed of wood or metal, preferably metal. Local artisans are available in every community who are able to perform the necessary construction work at a very economical figure. All beat telephone lines obviously should converge at local police headquarters.

The recall-signal system.—Of the greatest importance is the establishment of some form of visible or audible alarm by means of which the central station may signal to members of

the force that they are wanted. In an emergency, it is seldom indeed that a police officer is close at hand or even quickly available by ordinary means. It is fundamental in the service that there must be some way to permit prompt contact with all members of the available force by day or night.

The small area of these towns makes the installation of an effective signaling system a simple and inexpensive matter, yet relatively few communities have availed themselves of this valuable device. In a recent survey of 225 towns in this population classification,[2] it was found that 207 possessed no signal equipment whatsoever. One town had a first-class aviation beacon; half a dozen employed a combination bell and red light placed on the town water tower; two had master switches by which the street lights could be flashed. About one-fourth of the towns used the fire siren, and the rest a red-light device in one form or another. Expense was often a primary consideration, sometimes to the point of absurdity. In one town where the red light was placed on the water tower, it was fastened on one side of the tower because that meant a saving of a few dollars. The fact that it was visible only to patrolmen on the north side of the town was not considered.

Good signal equipment may be installed for a modest sum, well within the budget limits of any police force, no matter how small. The equipment may be designed to provide an audible or a visible signal, or both. The silent, visible signal is recommended. Although its power to shock the senses of perception is small when compared to that of the audible signal, experience has shown that officers soon grow accustomed to watching for the light, and the time response is almost always equal to the occasion.

Following are three of the many alternatives which may be adopted as a solution of the recall problem in the small community:

(1) One red-light signal unit of medium power, mounted at some high central point in such a way that it can be seen from all directions and from every part of town. The device

[2] *Report of the Law Observance and Enforcement Committee* (1931).

should be connected by direct wire to a suitable switch or push button at the central office.

(2) A series of red-light units at strategic street intersections where each will be visible from four directions, and equipped with the above-described operating connections.

(3) A cut-in switch at the central office, to flash the street-lighting system.

These may suggest other simple expedients and variations easily adaptable to local conditions. In every community, local electricians and even radio amateurs with the necessary electrical knowledge are both able and willing to lend their efforts and experience in the installation of these inexpensive devices. For the community needing a more elaborate installation, standard police-recall systems of the highest merit now available may be obtained at reasonable cost.

The general alarm.—Besides the police recall signal, every community in this class should have a general-alarm instrument, preferably a siren, to be sounded only in grave emergencies. In conjunction therewith, a definite plan of organization that will include all responsible citizens in the community should be developed in advance, as a policy of preparedness for unexpected emergency situations.

Burglar and holdup alarms.—The protection of banks and mercantile establishments in the small town against the inroads of visiting desperadoes is a problem of major proportions. Adequate alarm protection offers the only satisfactory approach to its solution, since, regardless of the existing form of police protection—whether city marshal, chief of police, sheriff, constable, or state police—the police agency must receive notification of the attack without delay. There is no other known device or method that will discharge this function so well as the electrical circuit.

All banks and mercantile establishments in the community which have special attractions for bandits or burglars should be electrically protected, with all transmission lines wired direct to the police central office. It is, further, a simple matter to connect the alarm circuits in such a way that when they

are disturbed they will operate the recall-signal lights automatically.

Many types of burglary and holdup protection devices are available. If these are too expensive, local electricians may be depended upon to design alarm contacts and terminals which will serve the purpose admirably. It should be borne in mind that the alarm "touch off" or exciting device is the critical element in any form of alarm system, particularly those designed for robbery protection. Footrails, push buttons, and other devices generally used in the touch-operated system should be replaced by special currency trays, money drawers, and other devices which are actuated by the normal physical motions of a bandit in executing a robbery. Here again, the advance preparation of a plan of operation for the local force is to be strongly recommended.

Thus, through a centralized system of communication, the local force is in a position to handle an emergency. In the event of a bank attack, for example, the alarm system provides immediate notification at the central office, and through the recall and telephone systems the available force may be mobilized without delay and the premises surrounded. Should the visitors be fortunate enough to break through this cordon, another trap awaits them.

Highway control points.—Leading out from every city and town are main arterial highways and laterals which offer convenient avenues of escape after the commission of a crime. An examination of the map covering any given community and the immediate surrounding area will reveal certain strategic points on these thoroughfares which, in an emergency, should be covered promptly by one or more officers. The communication plan of the community should provide in advance for the prompt movement of officers to these control points. An advance survey of communication facilities should be made and a pre-emergency plan developed for rapid contact with outside departments, so that the control points may be placed under observation in the shortest possible time. Conferences should be held with the police and sheriffs of sur-

rounding counties, cities, and towns with this end in view, and for the general purpose of coördinating for emergency operation the efforts of all police forces and equipment in the immediate area.

In the absence of any other means of communication for this purpose, the telephone system is always available. Intercity telephone service is now extensively used to provide a swift method of communication between police organizations. The speed of this service may be more fully appreciated when it is realized that more than 95 per cent of all intercity calls are now completed while the calling party remains at the telephone. The average time for completing such calls is less than two minutes.

Intercity number books or directories are a convenient aid in emergency operations, and branch offices of the telephone company will prepare such directories without charge for any police organization desiring them. Sequence calling lists may also reduce the time required to speed the notification of an alarm to a number of points. By this method only one request need be placed with the operator; as fast as one call is completed she sets up another. Telephone-company representatives will be glad to give full information concerning this telephone service.

Where the small community is within a regional area possessing an organized regional police communication system, the problem of caring for control points in an emergency is greatly simplified, since this is one of the principal functions of the system. Through the facilities of the teletypewriter and radio communication, mobilization of forces in the area is effected without delay and their movements are directed with telling effect. Meanwhile, until the regional-system idea has gained widespread adoption, it is a responsibility of local officials in the community to take inventory of their preparedness for emergencies and so organize communication and available manpower as to be ready when the attack comes.

Chapter XIII

FOREIGN POLICE COMMUNICATION SYSTEMS

A survey of the police-communication systems in leading cities outside of the United States reveals an unusual similarity among the main devices employed. In Shanghai, Singapore, and Melbourne, in London, Paris, and Berlin, the telephone and telegraph, call boxes, recall signals, teletypewriter, and radio are the chief reliance of the police in meeting the necessities of police communication. It is not to be understood, however, that all the large cities surveyed made use of all these instruments in their respective communication plans. In fact, very few cities have installed communication systems in which each of these facilities is so employed that the whole presents a complete and balanced arrangement.

Some cities which employ teletypewriter and radio, for example, do not maintain a beat telephone and recall system, which is considered almost a *sine qua non* of police communication in the United States. In others, the communication equipment of the police department consists of nothing more than the regular telephone and telegraph facilities plus a few private telephone lines. It is only in such large cities as London, Paris, and Berlin, situated in highly industrialized and technically advanced countries, that the police have progressed toward a more complete utilization of the modern communication facilities now available for police service.

In studying the police-communication systems of foreign countries, it is well to bear in mind certain differences between their police problems and police organizations and those of the United States, which account in part for differences in their respective communication structures. In the first place, the police of most foreign countries are organized on a military or semimilitary basis and are under state control. Even in those countries where independent municipal police forces do exist, they are usually relatively unimportant

in comparison with the national gendarmery. This tends to concentrate attention on the development of long-distance communication facilities, to the detriment of such local and decentralizing means of police communication as the beat telephone and recall signal, which appear relatively unimportant to these state-police organizations. Thus the police of Hungary, Italy, Poland, and some of the states of Australia, have well-developed telegraph and radio equipment but lack any appreciable amount of local communication facilities.

In the second place, as Fosdick pointed out,[1] many of the prewar European police forces did not rest on a popular basis, but were the instrumentalities of a ruling class; and this condition still exists in spite of many changes in the constitutional forms and theories of government which have taken place as a result of the war. The police departments of these countries function more as political instruments than as agencies for the discharge of strictly police duties. Conditions in Hungary, which are typical of a large number of such countries, are thus described in a confidential report by one competent observer:

> The World War, the revolution of 1918, bolshevism in 1919, and the particular economic and labor conditions resulting from the loss of two-thirds of its former territory, all make it necessary for the state to follow with the closest attention any matter involving public order.
>
> Well-organized gangs of the American type are unknown. There is no "industrialization of crime." The police have only to deal with individual criminals or small *ad hoc* organized groups of them. On the other hand, the endeavors of Soviet emissaries, and certain unsettled local problems, make preventive work and prompt, energetic action by the police an urgent necessity in any attempts of organized groups to overthrow the established government.
>
> For this reason the intercity system of communication is well developed and resembles a military organization, while communication between the individual patrolman and the police station has been rather neglected. It is considered of greater importance to get through promptly the orders from headquarters to the separate units and reserves than to increase the speed of communication between patrolmen and their immediate superiors. Individual crimes are comparatively unimportant in the eyes of the police authorities, while they see considerable danger in

[1] Raymond B. Fosdick, *European Police Systems*, Chap. II.

mass demonstration, riots, and revolutionary activities. To be prepared for these and for their speedy suppression, the present system was developed.

The effect of such conditions upon the police communication system is adequately pointed out in the quotation.

Again, the economic and social conditions, as well as the police customs of certain countries, have a decided effect on police procedure and the development of police communication. Certain countries are so backward economically that crime itself is sporadic and primitive and no complex communication system is required to deal with it. In other countries, rigid police control of the movements of people has evidently forestalled the need for, and the development of, certain means of communication. Thus the city of Tokyo, Japan, and its environs, with a population of five and a half million people concentrated within a relatively small area, would appear to present a serious problem in police communication. Nevertheless the present system of police administration seems well adapted to the conditions and operates successfully with communication equipment much less modern than is found necessary in European and American metropolitan areas of comparable size. This is partly because of the fact that in Japan records are kept by the police of every person throughout the Empire. Landlords, houseowners, and local authorities are required to report weekly concerning arrivals and departures of persons coming under their cognizance. Under this system it is practically impossible for any person to go anywhere within the Empire and keep knowledge of his movements from the police. Automobiles, moreover, are rarely used by criminals in escaping from the scene of a crime, owing to the scarcity of the vehicles and to the fact that, with the exception of urban centers, automobile transportation is seriously hampered by lack of roads. Because of these and similar factors, rapid communication facilities, such as radio, are not urgently needed in Japan at the present time.

Finally, the geographic proximity to one another of the nations of Europe has prompted the development of a system

of international police coöperation and radio communication the like of which is to be found nowhere else in the world. The significance of this development should not be lost upon the United States, where people are becoming aware of the acute need for greater coöperation between the police forces of various governmental units. The accomplishments of European police officials in achieving such organized coöperation, despite the difficult barriers of national rivalries, differences in language, and the antagonism left by the World War, should spur this country to a more rapid development of regional police coördination.

With these differences in mind, a brief description will be given of the outstanding communication systems of police organizations throughout the world. For purposes of this discussion, the map of the world has been roughly divided into certain areas within which there seem to be approximately like police problems and police organizations, with a corresponding similarity in communication equipment and procedure.

POLICE COMMUNICATION SYSTEMS OF EUROPE

GREAT BRITAIN

The London Metropolitan Police.—The London metropolitan police district, for the safety and protection of which the London Metropolitan Police Force is responsible, comprises an area of seven hundred square miles and a population of almost eight million people. It includes, roughly, all the area within a circle of fifteen miles' radius from Charing Cross, with the exception of the City of London, which has a separate police force to guard its one square mile of area in the center of Greater London. Within this huge metropolitan area are to be found two whole counties (London and Middlesex), parts of four others (Surrey, Essex, Kent, and Hertford), and forty-two boroughs, three of which (Croydon, West Ham, and East Ham) are county boroughs.

This police district is divided into twenty-two divisions, with one additional unit to patrol the River Thames. These divisions are of unequal size, ranging from less than one

square mile in the center of the district to more than eighty-two square miles in the outlying districts. Each division is in turn decentralized into subdivisions, which contain a varying number of police stations. The police station is the lowest organizational unit of the Metropolitan Police Force. To the station are attached the constables and police sergeants who patrol the area assigned to the station. For the purposes of patrol, moreover, the territory is further decentralized by dividing the station area into sections in charge of sergeants, and the sections into beats patrolled by constables.

The communication system required to serve this huge area with its force of twenty thousand policemen is necessarily complex. The chief instruments relied upon by Scotland Yard for rapid communication are the telephone, the Creed teleprinter, and the radio. A private telephone system connects headquarters with all divisions, subdivisions, and police stations. The telephone-booth system, introduced by Chief Constable Crawley at Newcastle-upon-Tyne,[2] is now being installed in the district and will extend the telephone system to the lowest unit in the organization, the constable on the beat. By means of this telephone system, the beat patrolman and the public can instantly communicate with a police station, or with any officer in any divisional, subdivisional, or headquarters office of the force.

In order to increase the speed and improve the quality or interstation communication, especially in the accurate transmission of messages of general interest to the whole department, or a part thereof, the Metropolitan Police have started a plan for the progressive installation of Creed teleprinters. Six of the machines are already in use, affording two-way communication between headquarters and three divisional stations. Plans for introducing an extended teleprinter network for Scotland Yard have already been engineered, and the Post Office has been authorized to install equipment.

New Creed page teleprinters will be first installed to provide communication between the Yard and the twenty-three

[2] See page 89, above.

divisional and three subdivisional stations. The switchboard will be so arranged that three services will be available: (1) broadcast from Scotland Yard to all divisions; (2) broadcast to any selected group of divisions; and (3) two-way communication between Scotland Yard and any other division. After this installation is completed, it is planned to expand the network to include all the subdivisional stations and perhaps all police stations. With the introduction of the police-booth system into the district, it has been suggested that even these enclosures be so equipped. This would make possible the simultaneous printing of urgent messages from headquarters on all the machines in the boxes, for the attention of patrolling officers.

In accordance with the practice of other modern police departments, Scotland Yard has adapted radio communication to police uses. A central broadcasting station has been established on the top floor of the headquarters building, from which messages are broadcast to the various radio-equipped automobiles and trucks of the department. The number of radio-equipped cars used by the department is rapidly increasing, the present total being approximately two hundred and twenty. Some of the lighter cars are equipped with receiving instruments only, while many of the one-ton lorries maintain two-way communication with headquarters, since they carry both receiving and transmitting equipment.

Borough police forces.—With the exception of the Metropolitan Police Force, all police departments in Great Britain serve either a borough[3] or a county. Until recently, police communication in the principal boroughs of Great Britain was somewhat backward when compared with the system of the Metropolitan Police Force, and with the communication systems of American cities of comparable size. Telephones installed in police booths composed the entire communication system of police departments in almost all English cities. At present, however, there is a decided trend toward the adoption of more modern facilities. Birmingham recently added

[3] Incorporated cities in Great Britain are known as boroughs.

a complete beat telephone and recall-signal installation to its system of police communication, and other communities are planning similar improvements.

Generally speaking, large cities, such as Liverpool (855,530 population), Manchester (751,900 population), and Sheffield (524,900) are not equipped with teletypewriters or with radios, and depend entirely upon the police-booth system and motorcycle dispatch riders for communication purposes. Although Great Britain with its many large cities situated in a comparatively small area offers an ideal opportunity for the installation of an intercity teletypewriter network, such a system has not yet been placed in operation, chiefly because of the expense involved. The same inertia which retards the expansion of the teletypewriter in this country is also felt abroad. In none of the British boroughs do important banks or mercantile establishments have burglar-alarm systems connected directly with the police stations. Existing alarm systems are of the type which sounds a local alarm outside the premises.

The most noteworthy trend in police communication in English cities, both large and small, is toward the adoption of the police-box system and the consequent decentralization of the department. Communities of varying size and area are rapidly adopting the Crawley police-box system, the latest installations being made by the London Metropolitan Police and the police of Edinburgh. The system is now in operation in large cities such as Manchester, Sheffield, Nottingham (population 265,700), and in smaller cities of which Chesterfield (66,450), Derby (137,700), Doncaster (58,230), Grantham (18,902), Rotherham (72,040), Bannley (73,790), and Bootle (76,799) are representative. Liverpool, the outstanding exception, has not yet adopted this system.[4]

County police forces.—The county police forces of England are, according to Fosdick,[5] of much greater importance

[4] See Chief Constable Frederick James Crawley, "Decentralization and the Police Box System," *Proceedings of the International Association of Chiefs of Police,* pp. 60–65 (1929).

[5] *European Police Systems,* p. 61.

than the borough police. Every administrative county has an organized police force, which has jurisdiction over the entire area of the county with the exception of boroughs of more than 20,000 poulation which maintain their own police departments. Many towns and boroughs with populations in excess of 20,000, however, do not possess established police organizations of their own and therefore depend upon the county forces for police protection. The county police thus carry the burden of communication problems, both urban and rural.

In the urban areas under their jurisdiction, the police communication systems of the county forces are similar to those in the boroughs. The police-booth system is now being extended to rural districts in some counties and, in conjunction with mobile patrols, is proving quite successful. However, most counties have yet to provide communication between headquarters and the constable in charge of a rural beat.

Lincolnshire, a typical agricultural county, is divided into ten divisions, each under the charge of a superintendent with headquarters in a town. Each division is decentralized into two or more subdivisions under the supervision of an inspector, and the subdivisions are divided into sergeants' sections. A sergeant is in charge of about four constables' beats. The constable resides in his beat, which comprises an area of from six to eight square miles. Telephones are installed in the offices of the superintendent and inspectors, at sergeants' stations, and at certain constables' stations in areas where these are placed at important points. With many beat constables, however, direct communication is not yet possible, but, since the sergeant visits the constables in his section daily and prepares their individual "routes" of patrol, he knows where to find any of his men at any time.

A distinct handicap is the difficulty of conveying urgent messages to a constable on an isolated beat. There is a lack of rapid communication between the directing authority and the patrolling officer, although the latter may communicate with his superior at any time by using the Post Office Telephone

Service either at the village post office, or from any of the houses in his beat area where a telephone is installed. In addition, post-office telephone booths are being set up in country districts, and there are the telephone boxes at important road junctions maintained by the Automobile Association and the Royal Automobile Club, to which the beat constable has a key for use in emergencies.

In view of the fact that the present rural beat system will doubtless be superseded by mobile patrols, radio communication should become of great importance to the county constabularies. A committee chosen by the Chief Constables of England has been appointed to consider the possibilities of radio, but no conclusion has as yet been reached. Radio communication between headquarters (the chief constable's office) and the superintendents in charge of divisions has been the object of experiment in Lancashire and the West Riding of Yorkshire, but, in the words of the chief constable of the latter force, "has not yet been put to practical use." The Lancashire force has at least one car equipped with radio.

The English police have given much attention to the design and use of small portable radio receivers which may be carried by the individual officer as part of his personal equipment, much the same as his handcuffs and baton. At Brighton and Bradford, this type of equipment has been used successfully for the transmission of orders and instructions from headquarters to the patrolling officer. Work is progressing at the present time on the design of a portable transmitter with similar specifications which will permit two-way communication between the patrolman and his station.[6]

The Lancashire teletype system.—The teletypewriter, which would meet ideally many of the communication needs of county forces, has as yet been installed in but one county, Lancashire. This system, which has been in use since March 1, 1932, consists of a central teleprinter station at headquarters, and teleprinters at each of the eighteen divisional stations of the county. The system does not extend beyond the

[6] See "Radio Patrol Operation," Chap. V, p. 157.

divisional station, messages being sent to sectional stations by means of the private telephone lines of the department.

The apparatus at headquarters consists of a teleprinter switchboard, two teleprinters, an automatic transmitter, and a keyboard perforator and reperforator. The divisional stations are each equipped with one teleprinter and a rectifier. The system is so arranged that it is possible to transmit from headquarters to any station individually, or to all or a number of them simultaneously. Messages coming in from a division which require circulation are received on the reperforator, in addition to the teleprinter; the reperforated tape thus obtained is used to send the message out again by means of the automatic transmitter, which operates at a speed of sixty-six words per minute. The keyboard perforator is also used to prepare punched tape for the automatic transmitter when necessary.

The Lancashire teleprinter has proved a great utility to the force and is, in the opinion of the police officers, an unquestionable improvement over the telephone in the transmission of messages, reports, and broadcasts. This undoubtedly provides an example which other counties will follow as funds become available. Ultimately, all the county and borough forces of England may be brought together in a national teleprinter network centering at Scotland Yard.

FRANCE

Paris.—Paris, the administrative center of France, like London, the British capital, is policed by a metropolitan police force which has jurisdiction over the Department of the Seine, an area of some 185 square miles. For police purposes, this area is divided into 20 districts, called *arrondissements,* and each *arrondissement* is divided into four quarters. The quarter is under the charge of a sergeant, who is responsible to the captain in command of the *arrondissement* in which the quarter is situated. The station at which the captain has his quarters becomes the district headquarters, and is the center of the communication system of that area.

For so large and important a city, Paris is relatively backward in the development of a modern system of police communication. It is only recently that the Paris Prefecture of Police has organized a signal system for the use of both police and public. This system permits a citizen, by the simple operation of breaking a glass on a street alarm box, to notify the district police station of his need for police assistance, and, if necessary, communicate with the station by telephone. The same box contains a telephone for the use of the patrolman in communicating with the district police office and with the chief of police at headquarters. In February, 1932, there were 600 such telephone posts in the city, and many others were to be added in the course of the year.

The Parisian police, moreover, lag behind the London metropolitan police in the utilization of the radio and radio-equipped motor cars. The Prefecture has studied the matter of automobile patrols equipped with radio, and plans have been made to organize patrols of this kind in the near future. The cars will be fully equipped with sending and receiving apparatus and will be continuously in touch with police headquarters.

Banks and large business establishments in Paris do not at present have burglar alarms connected by direct wire to near-by police stations. However, a private organization approved by the municipal authorities plans to install such a system before long. Subscribers will then be able to call the police station of their district by simply pulling a lever. In design and operation, the equipment resembles the "Notruf" system which is being widely adopted in Germany.

Other French cities.—The communication equipment of the important provincial cities of France, like that of the boroughs of England, consists mainly of telephones and is comparatively simple. Bordeaux (267,990 population), which may be taken as a typical example, is divided into eleven police districts, each under the control of the precinct headquarters, known as the "Commissariat." Each commissariat has within its area a number of *postes de police,* which are small

stationary posts with an enclosure housing two policemen. A private police telephone system connects the *postes de police* with the commissariat, and the commissariat with the *Permanence* (police headquarters). No other means of communication are employed.

HOLLAND AND BELGIUM

The principal police forces of Belgium are the municipal police, the national *Gendarmerie,* the maritime police, and the criminal police (*Police Judiciaire*), a detective force attached to the various courts. Each of these forces has developed a communication system best suited to its individual needs. In each city of Belgium, no matter how small, there is a municipal police force under the command of a chief of police or the burgomaster, which has jurisdiction only over its own municipal territory. Thus, in Brussels, which comprises seventeen municipalities, there are seventeen independent police forces.

Since the telegraph and telephone are public utilities operated and owned by the government, all local police forces have the use of these services without tolls. The public telephone and telegraph are the only means of communication used by the municipal police of all but the largest cities in Belgium. Brussels, the capital city, has developed the most complete system of municipal police communication, and this in spite of the handicap presented by its numerous independent satellite cities.

Besides the public telephones with which all the police stations are equipped, the central police station of Brussels is connected by private wire through its own exchange with all police substations, with the Burgomaster, the *Police Judiciaire,* the King's Attorney, the Army, and the fire stations. Unlike Antwerp, which is larger than Brussels proper, in Brussels the police have a system of private telephones installed in small boxes attached to the walls of buildings along the principal streets, by means of which every policeman can report unusual occurrences to the central division. There is, however, no recall system of any kind associated with these

police-box telephones, the recall not being used anywhere in Belgium. The use of alarm devices connected directly with police stations is forbidden by police regulations.

The national police force of Belgium is composed of a body of 6000 gendarmes distributed throughout the country. There are at least five gendarmes to each three or four localities. They coöperate with the municipal police forces but take their orders from their own officers. The only means of communication now employed by this national police force is the public telephone and telegraph, although a system of radio communication between all stations of the force is being planned by the Belgian government.

Radio is not used by any of the municipal police forces of Belgium, either for intercommunication between the different cities or for sending messages to radio-equipped police cars. The maritime police, which maintains order on the rivers, canals, and in the ports of the country, does make use of radio equipment to transmit orders to the single river patrol boat operated by the government in the short stretch of the Scheldt River belonging to Belgium. Messages are transmitted by telephone to the wireless station on the river front, which then forwards these communications to the boat. Radio telephony and telegraphy are also used by the *Police Judiciaire,* under the direction of the King's Attorney, to keep in touch with the international criminal wireless station of Berlin.

The two principal cities of Holland, Amsterdam (746,746 population) and The Hague (432,041 population), are fairly well equipped with police-communication facilities. Since the Amsterdam police, who are just installing a complete police-alarm system, have not seen fit to copy the system already in operation at The Hague, a description of both systems will be given.

Aside from the usual public telephone and telegraph facilities accessible to the police, and the radio, the outstanding feature of police communication in The Hague is a network of one hundred alarm telephone booths stationed on the public streets, by means of which communication is established be-

tween the policeman on street duty and headquarters. These booths, which are also at the disposal of the public for notifying the police and fire departments of an alarm (police and fire departments of The Hague are combined into a single force), are marked by a conspicuous sign, "Alarm, Fire, Police." They are, as a rule, built into kiosks in which newspapers, magazines, and refreshments are sold, and the salesman coöperates with the police by keeping a watchful eye on the interior of the booth through a small window. Booths are also placed in street car waiting rooms, transformer buildings of the municipal electric service, schools, and occasionally in ordinary houses. Every effort has been made to place the hundred units at the busiest points of the city and in the most conspicuous places.

The booths may be entered from the street by means of unlocked half-doors which cover the upper section of the opening only, and so prevent false alarms and maliciousness by making the occupancy of the booth semipublic. Within the enclosure is a telephone connected by direct wire to the central operator at police headquarters. A notice above the telephone contains the instructions: "Take receiver off hook, listen until police reply; after speaking, hang up receiver."

The recall signal operated in connection with these booths is an unusual and ingenious device. Within each booth, and in a place not visible from the street, is a tiny cupboard in which, behind a small square window, may ordinarily be seen a white disk. The telephone operator at headquarters, through the operation of an automatic device, causes this white disk to be replaced by a red one with a white cross. The presence of the red disk signifies that the policeman on the beat must call the police station. The beats of the policemen are so arranged that they lead as often as possible past the alarm booths, and since the patrolmen must inspect the signal apparatus in every booth they pass, and since the booths are at the central points of the beats, which are placed from 15 to 30 minutes' walking distance apart, the inspector of a station may reach his officers on duty at regular periods in order to

Foreign beat communication equipment: The Hague, Netherlands. Interior of police booth, showing telephone unit. A notice above the instrument says: "Take receiver off hook, listen until police reply; after speaking, hang up receiver."

transmit any necessary orders or information. If, at the end of a conversation, the policeman is told that the recall signal is no longer needed, he can replace the red disk with the white one by turning a special key on the back of the cupboard.

The system offers a splendid method of supervision, since it can easily be determined at the station whether the officers call at the various central points at the proper times. But defects of this recall system are apparent. It does not permit the recall of a specific officer or group of officers, and, since the signal cannot be seen except at the time of the regular inspection of the booth, the lag in time of response may be much too long.

The only use made of radio in the police work of the Netherlands consists of daily broadcasts of bulletins from the police radio-broadcasting station at Hilversum. The police headquarters of The Hague and other cities are equipped with sets for receiving information which is sent out at stated times each day. Any information which the police of the various cities wish to disseminate by radio is sent to Hilversum by telephone and is broadcast from there.

Up to the present, neither a police-box system nor any of the similar mechanical devices so well known to the police of the United States has been at the disposal of the Amsterdam police or public. When emergencies have arisen making it necessary for policeman or citizen to communicate with headquarters or any of the precinct stations, the only available means has been the ordinary public telephone. Since Amsterdam, with a population of more than 746,000, has only about 30,000 telephone subscribers, not infrequently there has been much delay in obtaining the desired connections, a difficulty especially noticeable after 8:00 o'clock at night, when most of the small shops and all the department stores and offices are closed.

To remedy this situation, plans have been completed for the installation of an alarm system which will afford mutual communication between headquarters and the patrolmen and enable citizens to call for police assistance without delay. The

Foreign beat communication equipment: The Hague, Netherlands. Police booth, exterior view, showing how doors only cover upper section (about two-thirds the height of the entrance) so that the lower part remains open and may be inspected from the street.

alarm-system units will be installed in steel cabinets fixed to four hundred pillars, which now support the fire-alarm boxes. These pillars are but two minutes apart, so that the effective distance to a beat telephone will be only one minute at the most. Each unit will be equipped with a telephone, a siren, and a recall signal light installed in the rear half of the fire-alarm cabinet. Patrolmen will be supplied with keys and will be able to unlock the cabinet and get telephone connection direct with headquarters. The citizen will be able to communicate with the station by breaking a thin pane of glass and pressing a button which causes the door of the cabinet to spring open, thus making the telephone accessible. The recall equipment of the system consists of a calling lamp installed within the cabinet and visible from both sides through windows, and a siren. Should headquarters desire to communicate with a policeman on a particular beat, it will be able to do so by illuminating the calling lamp as a means of notification. In order to draw immediate attention, the sirens in the pillar cabinets in the specific section under patrol may be put into operation.

Besides this modern alarm system now being installed, the Amsterdam police enjoy an efficient system of communication between headquarters and district police stations. The principal equipment is a teleprinter installation consisting of one sending and three receiving machines and the necessary machines in each of the fourteen district stations, and a switchboard by means of which headquarters can broadcast to all stations or carry on two-way communication with any individual station. The cable used for the teletype system is also utilized for direct telephone connections between headquarters and the district offices, and this telephone connection can be used even when the teletype is in operation. Communication traffic over the system averages 130 messages a day for each teleprinter, the length of the messages varying from 12 to 100 words.

Up to the present, alarm systems in Amsterdam have been, for the most part, of the type which gives a local signal out-

side the building in which the system is installed. Only a few of the government and municipal financial institutions are equipped with alarms wired to the nearest police station. This contrivance consists of a simple bell system which can be operated by the staff of the building concerned when police assistance is required. Technical difficulties have prevented the development of radio communication for police purposes. Despite the absence of such equipment, however, Amsterdam will have, when the alarm system is completely installed, one of the best police communication systems in Europe.

EASTERN AND SOUTHERN EUROPE

The remaining countries of Europe may be conveniently classed and treated together with respect to their police communication systems. With few exceptions, in most of these countries the state police force, organized along military or semimilitary lines and exercising jurisdiction over the whole country, is the most important factor in the maintenance of public order and the suppression of crime. Furthermore, sluggish industrial development in these countries and the consequent financial stringencies have prevented the development of complete and modern local police communication systems.

The chief emphasis has been placed on long-distance communication, and in recent years radio has been called upon more and more frequently to meet this need. Greece, Jugoslavia, Spain, and Portugal, however, constitute exceptions to this statement, for in these countries long-distance as well as local police communication has been neglected. Inquiries have brought the information that no special police-communication equipment, such as visual and audible signal accessories, beat telephones, or radio exists anywhere in Jugoslavia, Spain, or Portugal. Only telephones and the telegraph are used for police purposes. In Greece, the municipal police force is of such recent origin that it has not as yet been supplied with communication equipment, and no definite information is at present available in respect to any alternative methods employed for this purpose.

In the large cities of Poland, the police depend upon their own private telephone systems for local communication. These telephones are of the latest automatic central type and permit simultaneous communication with all receivers in the system. A few telephones, housed in metal boxes, are placed at busy

Foreign teletype systems. Central signal room, police headquarters, Amsterdam, Netherlands.

street intersections and in dangerous neighborhoods for the use of beat patrolmen. A loud alarm bell is associated with these units and is installed on the outside of the metal housing.

The chief communication medium of the Polish state police is the radio. This force possesses nine field and stationary transmitters with accompanying receivers. One of these units is operated as a central police radio station and maintains continuous contact with foreign police radio stations. The field

transmitters are used for communication purposes within the borders of Poland. The stationary transmitters operate in the band between 50 and 150 meters, with 50, 100, and 150 watts' output in the antenna. Each station is equipped with a regular receiver of German (Telefunken) make, and an auxiliary receiver to be used in emergencies. The field stations are of the short-wave type, working usually in the 44-, 72-, 86-, and 100-meter bands, with 15 watts in the antenna.

The police of Hungary are divided into two forces, both of which are controlled by the state. The city of Budapest and other large cities are policed by the Hungarian state police, and in the rural districts the gendarmery, a semimilitary organization, performs the same duties. The political and social conditions of Hungary, which have in large measure determined the development of the police communication system, have already been described. As indicated, because of these conditions, the main emphasis has been placed on intercity police communication, which is very well developed, while communication between the individual patrolman and the station has been rather neglected.

The state police in the city of Budapest consists of about 4000 uniformed patrolmen and 100 officers (exclusive of drafting officers and the detective corps). The men on duty are distributed among 130 police stations, which are grouped into 10 police wards, corresponding to the 10 boroughs of the city.[7] Communication between the patrolman on the beat and his station takes place only in extraordinary circumstances by means of either the telephone in a public booth or any private telephone, since the regulations of the Hungarian telephone monopoly require the owner to put his telephone, free of charge, at the disposal of the police, fire brigade, and ambulance service.

Each police station is connected by telephone to the public automatic city exchange. By means of this public telephone

[7] The Danube River, and four other police districts for the adjoining municipal and suburban areas, which have been incorporated into the Budapest police district, bring the total up to 15.

the police stations may communicate with district-station police, with headquarters, and with one another. Each of the twenty-two district police stations also has a direct line to police headquarters which does not pass through the city exchange. These lines are connected to a police central in the headquarters building which has, in addition to an ample number of city trunk lines, special lines to the chief of police, to important departments of the police, the fire brigade, the ambulance, the police radio station, and the military authorities.

Radio, however, is the mainstay in the system of police communication in Hungary. The equipment installed in 1930 proved entirely successful even during the first year of operation. The installation consists of a central station in Budapest, and four district broadcasting stations, one being placed in each of the district police headquarters at Szeged, Debrecen, Székesfehérvár, and Szombathely, with 233 associated receiving sets. The central broadcasting station is housed in a modern concrete building, equipped with steel doors and capable of being defended against rifle and machine-gun fire. The equipment consists of two broadcasting stations, of 600 watts and 70 watts respectively, capable of both telegraphic and telephonic broadcast. The station operates on a wave length of 70 meters for the Hungarian police station, communicates on the international police short wave at regular daily hours with Berlin, Vienna, Warsaw, and Bratislava, and on a special wave with the Berlin police center. Direct radio communication is also maintained with all Continental countries that have joined the International Police Commission.

Of the 233 receiving sets used by the police authorities, 134 are in Budapest. Each of the 130 police stations in the city has one, the other four being installed respectively in the Ministry of the Interior (the supreme authority in police matters), the Political Department of the Police, the offices of the Commander of the Police Force, and the offices of the Budapest Chief of Police. The other 99 sets are distributed over the

country among police authorities in the cities and to the commander of the gendarmery. A patrol car is being equipped as a mobile broadcasting and receiving short-wave station for special use in riots and other disturbances, and will function in coöperation with a similar mobile station to be established at the barracks of the Commandant-General of the Budapest police forces.

Italy is like the other countries of southern and eastern Europe in that the two principal police forces, the *Reali Carabinieri* ("Royal Carabineers") and the *Militi della Milizia Voluntaria Sicurezza Nazionale* ("Voluntary Militia for National Security"), are national military organizations under the control of the Ministry of the Interior. The police function in rural and urban sections of the country is discharged by units assigned from these two national organizations. The importance of the municipal guards in police matters, never very great, is rapidly declining in face of the development of the voluntary Fascist Militia. Besides the units of these forces operating in Rome, that city has had since 1925 a special municipal police force of 5000 men, known as the *Guardie Metropolitane* ("Metropolitan Guards"), and its members do all kinds of police duty, including the direction of traffic.

In Italian cities there are no such systems of beat telephones, and alarm and recall signals, as are commonly used in the United States. The only method of communication between the central police office and officers or agents on duty is by telephone to the nearest police substation. Rome has 29 substations for the municipal force and a similar number for the use of the military police. Unless, as in extreme emergencies, a special messenger on a motorcycle is employed, all communications between the central office and the men are sent through the substations.

Radio is used by the Rome police only for broadcasting police notices to points outside the city area. The equipment consists of a radio transmitter of 200-watts power, operating on a wave length of from 45 to 90 meters, with which it is possible to cover effectively an area of about 600 square kilo-

meters. Furthermore, ten police cars are equipped with portable transmitters and receiving sets, each capable of communication over an area of 300 square kilometers.

Police communication in both Spain and Portugal still depends exclusively upon the telephone and telegraph. The large cities, such as Barcelona, Madrid, and Lisbon, are divided into several police districts, which are connected to the central station by private telephone lines. In emergencies, the district stations may receive orders from police headquarters, but no similar system exists for transmitting orders from the stations to the patrolmen on beats, who can get in touch with their district station only by using a telephone in either a public booth or a private home. Beat telephones, recall signals, teletypewriters, and radio are nowhere to be found, even though the problems of policing such large urban centers as Barcelona (767,744 population), Madrid (816,928), and Lisbon (600,000) must be complex.

Radio and the teletype would be especially suited to the needs of police communication in Spain, for the principal police forces of the country, the *Guardia Civil,* the *Cuerpo de Seguridad,* and the *Cuerpo de Vigilancia* are national forces under control of the central government. The *Guardia Civil,* which deals with the suppression of serious crimes and the maintenance of political order, has 1000 officers and 30,000 men distributed among 3200 posts throughout the country. The *Cuerpo de Seguridad* is a national police force which does the principal patrol work in all the cities of Spain ; it is paralleled by the *Cuerpo de Vigilancia,* a similar force engaged in criminal investigation activities. Such forces would, of course, be more effective if controlled and directed through means of communication, especially since one of their primary responsibilities is the maintenance of political order.

THE UNION OF SOUTH AFRICA

Geographic social conditions in South Africa have operated to make police communication very primitive. The large area of the Union (472,347 square miles) is rather sparsely settled,

the total population being 8,013,697. More than 75 per cent of the population is composed of native and Asiatic peoples and much of the crime consists of the rather elementary offenses to be expected of aborigines coming into contact with civilization. The largest city in the Union is Johannesburg (population 288,000), followed by Cape Town (207,404) and Durban (146,324). All other communities in the area have populations of less than 100,000.

The entire territory, rural and urban, of South Africa is policed by one semimilitary organization of some 10,600 men, known as the South African Police.[8] For police purposes, this area is divided into eight territorial divisions, each of which is composed of from one to ten magisterial districts. Police posts occupied by a varying number of constables are scattered throughout the districts. Most of the posts outside of the cities police the wide areas that surround them, and the constables in charge have to make long journeys on horseback in order to cover their territory. Much of the criminal work is concerned with cattle-stealing by natives, which does not require the rapid means of communication so necessary in an urban and industrialized community. It is not surprising, therefore, that in the rural area, aside from the ordinary government telephones and telegraphs, there is no system of direct communication between patrolmen and police stations.

No police boxes, recall signals, or alarm systems exist in the whole dominion of South Africa. Radio is not used by the police, and although the three major broadcasting stations at Johannesburg, Cape Town, and Durban (and relay stations at Pretoria and Bloemfontein), all of which belong to a private company, are ready to circulate any urgent calls when requested to do so by the police, the occasions on which these facilities have been employed have been very few. In Johannesburg, the Deputy Commissioner of Police in charge of the Witwatersrand Division has been trying to interest the authorities in the installation of a police radio system. If the

[8] The one exception to this general statement is the city of Durban, which has its own municipal police force.

estimates for this equipment are not accepted, he hopes to be able at least to obtain a private telephone system.

AUSTRALIA

The self-governing Commonwealth of Australia is a federation of six states and two territories. Since, in Australia, the police is a state and not a federal function, each Australian state has a separate police force. These forces are organized on a territorial basis, each police force being responsible for the maintenance of law and order in the entire area of its respective state.

The police problem in most of these areas is sharply divided between the policing of the vast, sparsely settled hinterland and the maintenance of public safety in the cities. In most of the states, the greater part of the population lives in the cities. In the following discussion, the communication systems of the three principal states of the Union—New South Wales, Victoria, and Queensland—are considered.

The police force of New South Wales is composed of 3500 men posted to 700 police stations. The personnel of these stations ranges from city divisions of 300 men to back-country stations of but one or two officers. In the country, the mounted patrolmen cover beats ranging in size from 400 to 6000 square miles. To these men, no special means of communication are available while they are on patrol. Communication between their stations and headquarters is by the telephone, telegraph, and postal services.

The Victoria police force of 2150 men polices one of the smallest states of Australia, the area of Victoria being only 87,884 square miles. For police purposes the state is divided into 11 police districts, each of which is decentralized into subdistricts controlled by a subofficer or a constable, according to the population and conditions in the district. All communication between subdistrict and district stations, and between district stations and headquarters is, as in New South Wales, by the telephone, telegraph, and postal services. The same means of communication are employed in Queensland to

connect the Commissioner of Police with the various district headquarters, which are scattered over Queensland's sparsely populated 670,500 square miles of territory.

In policing the cities of the Commonwealth, the Australian police have made little attempt to maintain communication between the police station and the beat patrolmen. Only in one of the metropolitan divisions of Sydney have a few police booths been installed, by means of which the policeman and the citizen can telephone directly to the divisional headquarters. Neither Melbourne nor Brisbane makes use of a police-box system, for the police in these cities still follow the outworn practice of periodically calling in person at the police station for orders and messages.

For communicating between city headquarters and police cars, however, radio has been well developed by the police of Melbourne and Sydney. In Melbourne, experiments with radio communication between the police station and automobiles were begun in 1922, and have been continued. A well-developed system of transmission between the police broadcaster at headquarters and a number of radio-equipped patrol cars has been established. All the patrol cars in both Melbourne and Sydney are equipped with portable transmitters as well as receivers, making two-way communication possible. In emergencies, beam wireless service is also used by the police of New South Wales in order to communicate with another country.

A telephoto transmission system is in operation between Sydney and Melbourne, a distance of 600 miles, for the occasional transmission of photographs and fingerprints. The system is operated by the Postmaster-General's Department and employs Siemens-Karolus-Telefunken equipment. The Australian police authorities also report a high degree of success with the Collins Code System for communication in distant identification between Australia and Scotland Yard. During the entire period of its use, no erroneous identification has been made either by Scotland Yard or by the Australian police.

NORTH AFRICA AND THE NEAR EAST

With respect to their police administration, the countries of northern Africa and the Near East can be divided into two groups—those which have come under British influence, and those which have not. The first group includes Egypt, Palestine, and Iraq; the second, Turkey, Morocco, and Algeria. Police communication in the second group is more primitive than in the countries which have police departments organized by or under the influence of the British authorities. The telephone and telegraph are the only means of police communication in Turkey. In Istanbul, the largest city of Turkey (population, including suburbs, 1,003,486), the telephone is the only means of police communication. Central headquarters is connected with district headquarters by direct telephone lines, and district police stations, in turn, are connected with various police boxes in which an officer is in attendance either constantly or between fixed hours. There is no systematic reporting by the officers, telephones being used only in emergencies or when the subdistrict office wishes to get in touch with officers on point duty. In the smaller cities and the country districts of Turkey, police communication is still more primitive.

Algerian and Moroccan police communication is in the same stage of development as the Turkish system, even though Algeria has the advantages of French administration. The police of Algeria are of three kinds—municipal police for each city except Algiers, a state police force for the capital, and a semimilitary gendarmery which polices the areas outside the municipalities. Police communication is extremely simple, consisting only of the whistle for members of the force, and the telephone. The police force of Algiers, a city of 265,000 inhabitants, maintains communication between headquarters and the nine substations by means of a telephone installed in each station. No method is provided for keeping in touch with the patrolmen on the beat or the motorcycle squads which patrol the outlying areas. In spite of the primitiveness of the

system, the police seem to be able to cope with the problems of crime; for, as the American Consul at Tangier remarked concerning similar conditions at Morocco, "The Moorish population has extreme respect for the police forces."

The communication practices of the police of Iraq, Palestine, and Egypt, all of which have been organized by and under British influence, are in advance of the police forces of other countries of the Near East, chiefly in their use of radio and other signaling devices for communication with outlying or isolated posts. The Egyptian police in Alexandria, who do not as yet use the radio, employ a police-box telephone system in the outlying districts. A recall signal consisting of a large bell and a red light make it possible for the station to summon the patrolman to the phone. This system is to be extended to the other districts of the city as rapidly as funds are made available.

In Palestine and Iraq, the police forces are semimilitary organizations, charged not only with the maintenance of law and order in cities and rural areas, but also with the task of aiding in the regular patrolling of the border and other military duties. In both countries, the chief means of communication used are the telephone, telegraph, and wireless. Neither country is well equipped with public telephone lines and the erection of telephone equipment specifically intended for police patrols is well-nigh impossible because of the expense involved. For this reason, although the police make use of telephones wherever possible, and even on occasion carry portable telephones for connection at "plug-in" points along the main lines, the chief reliance of the police in isolated posts is on radio communication.

The Iraq police have a few wireless sets for communication with the police posts of the Southern Desert and Kundistan. In Palestine the police force operates eight wireless stations, the most important of which are in the Beersheba district. By coöperating with the Royal Air Force and the Frontier District Administration, relays can be put through to the north of Palestine, Syria, Transjordania, and Egypt.

Besides wireless, the isolated posts of Iraq use the heliograph to interchange information between outlying police posts and police stations, and in Palestine the Royal Air Force's method of ball-and-arrow code signaling and message pick-up has been adopted as an emergency means of communication; thus far, thirty-six of the most vulnerable posts and settlements in the country have been so equipped. The signaling apparatus consists of a number of white disks and stripes which can be set to various combinations to convey information to aircraft. The code includes an instruction to aircraft to fly low and pick up a message. A written message is placed in a special bag suspended by cord between two poles and the bag is picked up by a grapnel from the machine. The degree of success obtained through this method in practice drills has revealed, according to the Palestine police, that this may prove to be a valuable means of communication in times of emergency, should other systems fail.

THE ORIENT

Police communication systems developed in the Orient range from the extremely simple methods employed in countries like India and Siam to the highly integrated modern system installed in the International Settlement at Shanghai. As a rule, conditions of society and of crime in the Orient are such that the police can cope successfully with the criminal element without requiring a complicated communication framework. The unsettled conditions in China, however, and the presence of a large number of foreigners in Shanghai, as well as the great wealth concentrated there, have caused the police of the International Settlement to work out a communication system which will compare favorably with the best in Europe and America.

As previously indicated, existing conditions in Japan have, in the opinion of Japanese officials, made elaborate police communication technique unnecessary. The absence of a lawless foreign element in the community; the high degree of standardization of the customs and habits of the populace, which

inclines the people from earliest childhood toward strict observance of the law; the rigid police control of the sale and possession of firearms; the careful catalogue maintained of the movements of the population, and the complete police record of all inhabitants; the relatively small number of automobiles in Japan, which, including the approximately 90 per cent engaged in the taxi or hire service, are present in the proportion of 1 to about 650 of the population; the absence, outside of urban areas, of an extensive system of roads suitable for high-speed transportation, which greatly restricts the avenues of escape; and the extensive authority vested in the police, which is much greater than that obtaining in many other countries—all these conditions have contributed toward easing the problems faced by the Japanese police officials.

Police communication in Japan depends, therefore, almost entirely upon the telegraph and the telephone. Private telephone lines, with a total length of 74,230 miles, connect police headquarters in every part of the Empire, and almost all intercity messages are sent over these lines. Radio for police purposes is not used, either for sending long-distance messages or in the patrolling of urban areas. In the large cities of the Empire, also, such as Tokyo (population, including environs, 5,500,000), Yokohama (543,500), and Nagasaki (197,000), there is a uniform reliance upon the telephone for police communication purposes. A private police telephone system connects the headquarters station in Tokyo and in Yokohama with the precinct stations throughout the prefectures in which those cities are located.

Each of the precinct stations is in turn connected by private telephones to a number of "police boxes." These units differ from the police booth of England, for they usually consist of small one- or two-room structures, and their use ranges from serving as a mere sentry box to providing room and sleeping quarters for several officers. They are to be found in almost all Japanese cities—400 in Tokyo alone. Approximately 300 are connected with the 30 precinct stations of the Kanagawa-Kencho Prefecture, in which the city of Yokohama

is situated. Since most of the police boxes are manned by at least two men, one of whom spends part of his time on outside patrol while the other remains on duty at the post, it is possible to send orders for the patrolman to the box. Headquarters, all precinct stations, and the more important police boxes are supplied with telephones of the public system, thus enabling both the beat patrolman and the citizen to get in touch with the station.

Any description of police communication in China must take into account the differences between the systems developed by the native Chinese police forces and the splendid system of the Shanghai municipal police force of the International Settlement. The communication systems of the Chinese police forces in such cities as Hankow and Peiping do not depart greatly from the general low level of police communication in the Orient, although they are slightly ahead of Japanese practice in the use of electric burglar alarms.

The police of the International Settlement, undoubtedly because of the value of the property they must protect and the comparatively liberal budget allowed them, have developed a modern and adequate communication system that makes use of the most recent electrical devices. A brief description of this force and its communication system should be sufficient to convince the reader of the truth of General C. D. Bruce's statement that "the S. M. P., as they are locally known in that extraordinarily constituted Settlement, are probably the most up-to-date and efficient police force east of Suez. They can bear favorable comparison with any force either in Europe or Asia."[9]

A brief description of the Chinese police communication system will aid in giving a perspective for judging the Shanghai system. Police whistles, a private telephone system, and an extensive system of electric burglar alarms connected directly to the police station, are the principal features of the systems in Hankow and Peiping. The Peiping police also

[9] Brigadier-General C. D. Bruce, C. B. E., "Shanghai, The International Settlement and Its Municipal Police Force," *Police Journal* (London), Vol. I, No. 1, p. 128 (1928).

maintain a system of alarm-bell stations and have special public telephones for the reporting of fire alarms and robberies. The police whistle forms a very important part of the Chinese policeman's equipment, since there are no police boxes for summoning aid. Detailed instructions are laid down in both Hankow and Peiping for using the whistle in various situations, and much more emphasis is placed upon its use than in Europe and the United States.

The city of Hankow is divided into four police districts, Hanyang composing a separate district. The headquarters of the telephone system is at the Public Safety Bureau, which has lines to all the police stations and to the Gendarme Barracks. For the transmission of urgent messages, a relay system has been devised whereby the Public Safety Bureau may send messages to the principal station in each district, which, in turn, relays it to certain other stations, and from these points it may be transmitted to the remaining stations. When a station has an urgent report to make, it calls the Public Safety Bureau or the Gendarme Regiment, and then communicates with its neighboring stations, according to the plan. Although this relay system increases the time consumed and the possibility of error, it does spread the burden of repeating the message, so that no operator is required to call more than three or four stations. In Peiping, besides the private police telephone system, separate public telephone numbers are set aside for the use of the public in reporting fires and robberies. There are also five fire-alarm-bell stations manned by fire-brigade policemen. Fires are reported to these stations and the alarm is spread by means of the bells.

Because of the prevalence of the crimes of burglary and arson in Chinese cities, the police have made widespread use of burglar alarms installed in private houses and shops and connected to the police station by direct private wire. In every police station signal boards are installed, at which the alarm system lines terminate. Where brigands enter a shop or set fire to it, the attendant secretly sets off the alarm, causing a lamp to burn on the central board and a loud bell to ring. The

number of the lamp informs the police of the location of the disturbance and they immediately proceed to the scene of action. Great care is taken to see that the system is maintained in working order; the trunk lines and wires in the residences and shops are inspected twice a month by the police, and the batteries which supply the power are inspected once a month by an electrician of the Public Safety Bureau.

The International Settlement in Shanghai is a political area separated only by artificial boundaries from the vast native city and the French Settlement. Up to recent times when barbed-wire fences were erected in parts of the area, boundaries were in some places almost imaginary lines, open roads, or narrow streets. The wealth concentrated in the Settlement attracted criminals to make forays into the district, commit crimes, and escape to their hideouts in the native city where they were technically outside the jurisdiction of the Settlement police. Fugitives fleeing from the police forces of the native city or the French Settlement, moreover, were constantly seeking refuge within the International Settlement. Faced with these trying conditions, the Shanghai Municipal Police, as the Settlement force is called, realized that successful coping with the problem required the best communication equipment obtainable.

The communication system that they established consisted in 1931 of the usual public telephone network, radio-equipped patrol vans, a street telephone system, and a burglar-alarm system. Plans were completed at that time for the installation of a teletypewriter and an antikidnaping, direction-finding, control system. The center of the communication system is situated in a specially built chamber atop the police administration building, and is known as the "Communication Control Room." In it are installed the main telephone switchboard, the radio transmitter, and the street telephone central switchboard. In 1932, it was planned to install in this room the power apparatus and control switchboard of the teleprinter system, the teleprinters, and the plotting instruments for the direction-finding system.

For police purposes, the International Settlement is divided into numerous districts, in each of which a police station has been erected, and all these stations are connected with headquarters by private telephone lines. In addition, there are 139 street telephone boxes placed at advantageous points. The points for these telephones were not selected for beat use as in most American and European cities; they are strategically chosen near the boundary of the Settlement, or at boundary gates, or upon roads leading into outside territory and therefore likely to be used by criminals in their attempt to escape.

These telephones are used primarily in emergencies. The introduction of radio-equipped vans, however, has increased their range of usefulness considerably. The only communication a van has with headquarters when it is on its tour of duty is by means of the telephone boxes. Tests of radio apparatus are reported through them, and a van which has been unable to receive a call from headquarters because of the failure of radio broadcast may be located by means of the street telephone system.

All the telephones are connected directly to a separate switchboard at the district station controlling the area in which the units are located, and each station switchboard is in turn linked by a trunk line to the central control switchboard at headquarters. The telephones used are of regular type and are housed in the familiar type of iron box used in the United States. Each box has, besides the bell, a red light fixed to the pole on which the box is secured, or suspended over a road at that corner. The light is operated by a relay from the ringing circuit and will not cease flashing until the call is answered. As is the practice in many American cities, the system is maintained by the local telephone company.

The radio motor patrols of the Settlement police consist of twelve trucks, built in Shanghai and designed to accommodate ten men equipped with steel waistcoats. Each van is fitted with Marconi radio receiver apparatus and both earphones and loud-speaker. The transmitter at headquarters is

a Marconi X.M.B. 1a, 100-watt marine type, fitted with a buzzer circuit. The buzzer acts as a "howler" and is used to precede emergency calls with the result that if the patrolmen are out of the van for any purpose, the call is loud enough to summon them to receive the message. Although the transmitter is equipped with both microphone and telegraph circuits, only the microphone is used.

The burglar-alarm system used in the International Settlement is maintained and operated by the local telephone company. It connects the principal banks, jewelry stores, mills, and other establishments to the nearest police station. A dislocation of a disk contact at the subscriber's end excites a sending apparatus which punches the number assigned to that subscriber on a tape at the police station. It will be noted that the alarm systems are not wired to the central Communication Control Room; direct communication with the police station in the district concerned is considered by Settlement officials to be a speedier method of handling calls of this kind.

The program of expansion for 1932 included the installation of one Creed page-type sending and receiving teleprinter in each police station and three similar machines at headquarters. This system was to be "phantomed" over the existing street telephone trunk lines. Plans were also made to equip the Shanghai police with an ingenious kidnaping prevention device, adapted from the direction-finding services used in aviation. So far as is now known to the writer, this system has not been adopted by any other police force. The facilities were made necessary by the fact that kidnaping is probably more prevalent in China, and in Shanghai in particular, than in any other place in the world.

Briefly, the system will enable subscribers who are being kidnaped or otherwise attacked in their automobiles to let the police know instantly of the crime and where the victim is being taken. A radio transmitter is installed in the motor cars of all subscribers, which starts operating at the will of the person upon whom an attack is being made, by means of a privately known contact, and once started it cannot be shut

off. This call is picked up by the direction-finding apparatus installed in the police stations, and the reading of these stations is communicated to the Communication Control Room, which is equipped with plotting apparatus. The exact location of the car can then be plotted out and followed. In the meantime, police radio vans will have been directed to the route taken and informed of other necessary details to hasten pursuit and capture.

It was subsequently reported that in December, 1933, the Shanghai City Council entered into a formal agreement with the manufacturer, the main provisions of which are:

(1) The company is permitted to install and maintain in approved police stations, for three years, such equipment as may be necessary to operate the alarm system. All installations are subject to the approval of the Council, but the cost and maintenance thereof are a responsibility of the company.

(2) The Council agree that alarms received at the police stations shall be acted upon, although it is not to be held responsible if any call is unanswered.

(3) The Council is indemnified against any damage or injury arising out of the operation of the system.

(4) All users of the system must enter into a contract approved by the Council, which among other things provides for a penalty of $25 for each false or unnecessary alarm. Both the Council and the company have the right to object to the rendering of this service to any particular person or vehicle.

(5) In the event of breach of the agreement by the company, or of injury to any other undertaking, the service not being maintained in a continuous and effective manner, the Council may terminate the agreement on six months' notice.

Police communication in India, Siam, and the other countries of Asia, is rather primitive. In the large cities of India, such as Calcutta and Bombay, the only means employed by the police are the public telephone and telegraph. In Calcutta, all police sections and outposts are on the main city telephone system and arrangements have been made whereby police calls are given immediate attention, and urgent calls, known as XXX messages, are sent to all police sections and other posts at any time of the day or night. Police communication

is no further advanced in Bombay; and some districts in India have no telephones for police or any other purposes.

A similar condition exists in the Malay Peninsula, except for the city of Singapore in the Straits Settlements. The Singapore police communication system consists of a private telephone system connecting police headquarters with police stations and officers' domiciles, and a number of police-box telephone units scattered throughout the city. Certain jewelers' shops and other establishments have burglar alarms connected to the nearest police stations.

SOUTH AMERICA, THE CARIBBEAN, AND MEXICO

Police communication in all the countries of South America is still at a rather low level. Nowhere has it advanced beyond the installation of private telephone systems for connecting headquarters with precinct stations. In most of the large South American cities, the typical police-communication framework consists of a private telephone system, over the lines of which orders and messages may be transmitted between headquarters and the outlying stations. Patrolmen either report to their station in person or are visited by superior officers at stated intervals. In Buenos Aires the arrangement differs in that the forty-five precinct stations are connected to headquarters by telegraph instead of by telephone. In only one country of South America have the principal cities installed any means of communication between the patrolmen on beats and their respective stations, namely, in Chile, in the cities of Santiago and Valparaiso. Police radio systems, burglar and bank alarms connected to police headquarters, and recall-signal systems—none of these are installed anywhere in these countries. In Chile, which ranks among the most advanced of South American countries, burglary and robbery on the scale known to the United States are unknown, and it is reported that a bank robbery has never been committed there.

An awakening interest in police communication improvement is evident, at present, in many of these countries. Early

in 1932, the police in Buenos Aires had projected the installation of an extensive system of communication between patrol officers and their headquarters, and the purchase of radio equipment. The Chief of Police of Montevideo, Uruguay, was considering at that time the installation of a police radio system, and the proposed visit of a Police Mission from Madrid, Spain, to study the Bolivian police problem augured well for an improvement in communication practice in that country.

There is a lack of information concerning the communication equipment of the police of Central America, with the exception of that used by the police of the Canal Zone. There is no reason for believing, however, that it differs materially from its South American contemporaries. In the Panama Canal Zone, where American police administrative practice and equipment have been installed, the area is divided into two police districts, in each of which there is a central station and numerous police booths. The stations are equipped with connections to the regular Canal Zone telephone system and with a special police telephone system connecting with the booths. The booths are equipped with a loud signal bell and either a miniature semaphore signal or a small light for recall purposes. The central stations of the two police districts in the Zone are connected to the Paymaster's and Collector's offices by a push-button bell alarm, and a similar alarm connects the central station at Cristobal with the Post Office and the Chase National Bank.

The police communication equipment in capital cities of Cuba and Mexico are rather more typical of the systems found on the North American continent than those of the southern continent. In addition to the facilities afforded by the two public telephone systems operated in the Federal District of Mexico, the police department possesses a private system connecting headquarters with the fourteen precinct stations, and the precinct stations with approximately three hundred police call boxes at various points in the city. Patrolmen are required to call their precinct stations whenever they pass a

call box, which averages once in every twenty minutes. No recall signals have, however, been installed to operate in conjunction with these call boxes. The teletypewriter is not used and, although complete plans for a police radio system have been formulated, lack of funds has thus far prevented the installation of equipment. Many banks are equipped with alarm systems, most of which are imported from the United States. These are either of the outside-bell type, or of the silent-alarm type connected with the precinct station in the area wherein the bank is situated.

The communication system of the Havana police corresponds even more closely to that existing in American cities than does that of the Federal District of Mexico. Not only is headquarters connected with the precinct stations by a private telephone system, but numerous alarm boxes also supply a means of communication between the patrolmen and the station. These boxes are supplemented by a recall-light system which enables the station officer to call a single patrolman or a group of patrolmen to the telephone. In a critical survey of the Havana police department made in 1926, it was recommended that additional police alarm boxes and recall-light units be installed gradually as part of a progressive plan of improvement; it was also noted that a teletypewriter system connecting headquarters with the precinct stations would add greatly to the efficiency of the police force.[10]

CANADA

The fact that Canada is a federal state has made police protection primarily a provincial responsibility. The provinces have, in turn, granted to the cities within their boundaries the right of organizing municipal police forces, and some have created provincial police organizations for the protection of life and property in the rural areas. In addition to the police forces named, the central government of Canada maintains a police force of its own which has general police powers. To

[10] August Vollmer, *Report on the National Police Department of Havana, Cuba, rendered to the Secretary of the Interior of Cuba,* p. 14 (August, 1926).

assist an adequate understanding of the functions of this federal force, the Royal Canadian Mounted Police, a word must be said concerning the criminal law of Canada.

The Criminal Code is enacted by the Federal Parliament for the whole Dominion, but is enforced in the provinces by the provincial attorneys general. In addition to this general penal code, the federal government, the provinces, and the municipalities all pass laws having penal provisions. The Royal Canadian Mounted Police have the duty, therefore, of (1) enforcing the federal penal laws and acting as an investigating agency for the federal governmental departments over all Canada; (2) enforcing all law, both federal and the general penal code, in the vast territories of Canada which have not been organized as provinces, and which are, therefore, under federal jurisdiction. They also enforce all law in certain national parks, Indian reservations, and in the remote portions of certain provinces; and (3) under an arrangement effected in 1928, they have resumed the duty of enforcing all law, federal and provincial, in the Province of Saskatchewan, for which the province pays the federal government a stipulated sum. Since each of these police forces is faced with different communication problems, the methods adopted by the municipal, provincial, and federal police forces of Canada may now be briefly discussed.

The communication systems of the municipal police forces of Canada are similar to those in the cities of the United States. Almost all the large cities are equipped with private telephone systems, police-box telephones, and red-light recall signals. In 1930, the city of Winnipeg installed the first municipal police radio equipment in Canada, comprising a 600-watt Marconi transmitter at headquarters and a number of radio-equipped patrol cars. Montreal has also adopted the facilities of radio communication in police service. The Toronto police department has installed a teletypewriter system connecting headquarters with all precinct stations. Winnipeg plans to connect all banks and financial institutions to its police stations by a direct alarm system. Canadian munici-

palities are obviously aware of the need for equipping their police forces with the most modern facilities to aid them in maintaining an enviable crime record.

The chief problem in communication faced by the provincial police and the Royal Canadian Mounted Police is the conquest of space. The vast area of Canada, larger than that of the United States, must be policed by the forces of a few provinces and the national government. The population of most of the provinces is small in comparison to their size. Wherever the stations of these various police forces are in cities and towns, the public telephone and telegraph systems are available, of course, for communication purposes. The problem lies in maintaining contact with isolated posts and in the rapid dissemination of orders and information in emergencies. The provincial police of both British Columbia[11] and Alberta seized upon radio communication as a solution. In 1931, the Province of Alberta provided for its provincial police five transmitters, in Edmonton, Calgary, Lethbridge, Peace River, and Grand Prairie. These stations communicate with each other daily. More recently, a news item tells of the establishment of wireless contact between Royal Canadian Mounted Police Headquarters and their patrol at Bache Peninsula, seven hundred miles from the North Pole. "All is well," reported Corporal H. W. Stallworthy and Constables H. W. Hamilton and A. Munro, in their first message to the outside world in three years.[12]

American and Canadian policemen look forward to the time when the border territory of both countries will be served by a police communication network that will make possible the highest degree of police coöperation.

[11] See T. W. S. Parsons, "Wireless Telegraphy for Police Purposes—British Columbia Practice," *Police Journal*, Vol. III, No. 1, pp. 103 ff. (1930).

[12] *National Police Officer*, Vol. 5, No. 5, p. 7 (November, 1933).

POLICE COMMUNICATION IN GERMANY

Because of the completeness and also the complexity of the German plan of police communication, a discussion of the systems and practices to be found in that country has been reserved for the concluding pages of this chapter. Restricted in police personnel and budget by the terms of the Versailles treaty, and faced by a rampant crime situation resulting from the political, economic, and social upheavals in postwar Germany, police administrators have been forced to supplement the deficient man power of their departments by the adoption of new and improved mechanical facilities. The capital city, Berlin, aided by the Prussian Ministry of the Interior, has taken the lead in this modernization of police practice and technique.

Beginning in 1924 with the installation of a police-box alarm system in a part of Berlin, communication facilities have been expanded until at the present time the Berlin police have at their command a complete police-box and recall system, an automatic telephone system, a teletypewriter network, a radio communication system, and the latest in telephotographic equipment.

The Greater Berlin police communication system.—In order to appreciate the complicated nature of the police communication of Greater Berlin, it is necessary to keep in mind the large area and complex police organization which it serves. The Greater Berlin police, like the forces of many other capital cities of Europe, serve a metropolitan area that is larger than the city itself. The area over which they have jurisdiction is divided into approximately 180 precincts (*Reviere*), each containing a police station serving as a headquarters for the patrolmen of that precinct. These precincts are grouped into fifteen divisions or districts (*Bezirke*), each controlled by a divisional or inspection office. Between the divisional offices and the main office of the department are six group stations (*Gruppenämter*), serving as brigade headquarters. These group offices report directly to the headquar-

ters of the uniformed police, which in turn, reports to the office of the Police President.[13]

The telephone system.[14]—Before 1926, the Berlin police telephone system was of the manual switchboard type with girls and police officers as operators. The poverty of postwar Germany necessitated the withdrawal of most of the female telephone operators, since money could not be provided for salaries, and the transfer of the police officers from the Communication Bureau to traffic duty and other services of the department in which the need for additional personnel was imperative. To meet this situation, the installation of an automatic telephone system was one of the first steps in the complete reorganization of the entire police communication system.

The engineering of the automatic telephone network was a task of huge proportions, and it was accomplished with the precision characteristic of German ingenuity and initiative. Studies of the types of communication traffic to be accommodated, and the possibilities of an expanding use of the system in the future, and analyses of peak loads and distribution of business, and of intradepartmental and outside calls had to be made before the engineers could distribute the requisite facilities so as to ensure the perfect functioning and coördination of the entire system.

Principles of economy and safety made it undesirable to connect all the telephones in the system to one central exchange. On the contrary, the principle of far-reaching decentralization was adopted and automatic exchanges were installed in offices of the Ministry of the Interior, the Police Presidency, executive offices of the uniformed force, the six

[13] The municipal police departments of Germany have many more functions than the police of England and the United States. Besides maintining order, pursuing criminals, and regulating traffic, the Berlin police perform the functions of a fire department, health department, prison department, building department, and certain functions of a charity department. The uniformed police and the detective force are thus only two branches of the whole police department, which is presided over by the Police President.

[14] Richard Sienang, "Die Fernsprechanlage der Gross-Berliner Polizeiverhaltung," *Konsern Nachrichten* 3 (18), (1928).

group headquarters (*Gruppenämter*), the inspection offices and district stations (*Bezirke*), and the precinct stations (*Reviere*). At the present time, there are 38 automatic exchanges with from 40 to 800 participants, to which are connected approximately 180 small precinct switchboards having from 10 to 20 connections.

Through this telephone system, every partaker, no matter to which exchange he may belong, can automatically reach every other partaker of the system. Day or night, every person using the police telephone system has the assurance of being able to reach any other person connected with the system, quickly, and without the intervention of any human agency. The installation involved the rental of part of the connecting cables from the Government Telephone Administration. The rest of the cables belong to the police.

Besides these general aspects of the telephone network, certain points which make for efficiency in intradepartmental and administrative communication are worth mentioning. The secrecy of communication desirable in a police telephone system is provided for to a marked degree in the Berlin installation. Furthermore, many times in a busy day administrative officers will have orders and messages of the greatest importance to deliver which will require the right of way over certain wires, and this situation is provided for by the installation of a double switch in the privileged offices, which, when thrown, immediately interrupts any conversation and seizes the wires for the more important orders. An ingenious device enables the chief of the uniformed force to speak to the officers in charge of the six group offices simultaneously.

The police also enjoy the convenience of direct communication with the governmental offices of Prussia and of Berlin without going through the regular postal telephone network. Connections must, of course, also be provided between the police network and the public telephone system. This is accomplished by connecting the police controls with the controls of the postal telephone system by means of a so-called "half-automatic extension central."

Since the telephone system is the property of the police, the police department is responsible for its maintenance. Specially trained officers, including, in the beginning, those who assisted in the installation of the system, are detailed to this branch of the service. A special instruction course was given to the maintenance staff by the company which installed the equipment.

Police-box, recall, and burglar-alarm systems.[15]—It may surprise Americans, to whom the police boxes on street corners have been a familiar sight for decades, to learn that the first police-box system in Germany was installed experimentally in Central Berlin in 1924.[16] On the basis of experience gained with this installation, the Prussian Ministry of the Interior in 1926 formulated a set of specifications for the police-box systems which were later installed in Greater Berlin and other cities of Prussia. These specifications called for a police telephone unit similar to the automatic boxes in use in the United States, containing a telephone and automatic signaling apparatus, by means of which the police can: (1) summon the reserve emergency squads (*Ueberfall Kommando*) through an automatic call which can be sent from the outside of the alarm box without the necessity of opening the box itself, (2) maintain communication by means of a telephone instrument, specially designed to overcome all street noises, between every box and its precinct station (the connection of several telephones to one line was avoided so that a failure of one alarm box would not disrupt the service of several others); and (3) enable the precinct station to summon an officer to a particular box by means of a bell or horn during the day and a light signal during the night, without simultaneous sounding of the recall apparatus on the other alarms.

[15] Berliner Notrufaktiengesellschaft, "Notruf Polizei-Melde-Anlager" (pamphlet); R. Bugler, Direktor, "Die erste Polizeimelder-Anlage in Deutschland: Berlin Mitte," reprint from *Siemens Zeitschrift*, June, 1924.

[16] In fact, aside from a small installation in a part of the city of Oslo (Christiania), Norway, this was the first installation of its kind in Europe.

The police-box system of Berlin fulfills two distinct purposes, and the central equipment and cable net were designed and installed to meet these two needs. For eighteen of the twenty reserve squads of the Berlin police, alarm installations have been provided. For each reserve squad, this installation consists of a reception central with automatic supervisory apparatus installed in its headquarters, to which are connected a number of police and private box alarms. When an officer who needs help turns a key in the box, the automatic signal equipment is excited and a signal is sent to the reserve-squad central. This signal is registered on a tape, in Morse code, or at some centrals on a teletypewriter machine. It indicates the number of the box from which the call was sent, the date, and the time of receipt of the call. By opening the box and setting an indicator, the policeman can send in different signals, such as an ambulance call or patrol-wagon call, and other requests for police assistance. The last three positions on the indicator scale serve administrative control purposes only.

Upon receipt of an alarm on the reception panel, the officer in charge either dispatches the flying reserve squad or forwards the call for help to the precinct station nearest the box from which it originated. For this purpose, there is a repeater apparatus on the rear wall of the reception central. When the number of the alarm box concerned is placed on this apparatus and the proper selector switch is pulled, the number appears in code on a tape, or in figures on a register at the precinct station, which then sends out the necessary aid.

In order that the precinct officials may summon a policeman to a box, a recall light and bell are installed over each unit. Both the light and bell can be made to give steady or intermittent signals. In the first installation in Berlin-Mitte, these recall signals were connected to the central office in six loop circuits and the recall signal intended for one box was received on all the signals connected to that circuit. In the later installations, as required by the specifications of the Prussian Ministry of the Interior, it is possible to summon

an officer to a particular box without the simultaneous operation of other recall-signal units. The recall bell or light continues to operate until an officer responds by lifting the receiver of the telephone instrument in the box.

A noteworthy feature of the German police-alarm installations is the connection of private burglar alarms into the system. The police boxes which are attached to the reserve-squad alarm central represent but one-half of the alarm system. The other half consists of private subscribers who have alarms installed on their premises and connected by direct wire with the central in the reserve-squad headquarters. These private-alarm installations range from a simple mechanism installed in the bedroom of a private dwelling to elaborately wired systems designed to protect bank vaults and jewelers' windows. Special safeguards are provided to ensure the receipt of a signal even if the wires should be tampered with.

At the reserve central are kept duplicate keys and diagrams of the premises of the subscriber, so that the commander of the flying squad can plan his actions intelligently in responding to the alarm. The installation of private-alarm equipment, for which a rental is paid by the subscriber to the police, is being aggressively pushed all over Germany by the companies manufacturing the equipment. At present the system is to be found in so many cities besides Berlin that Germany takes the lead in offering this type of police protection to its citizens.[17]

The teletypewriter network.[18]—The Berlin police department has had a separate telegraph network connecting its various stations since 1853. The growth of the Greater Berlin area and the loop construction of the various circuits finally brought about a condition in which the telegraph installation was no longer adequate for the communication demands made upon it. The system was, moreover, objectionable because of

[17] The most general type of burglar-alarm system installed in Germany is known as the "Notruf." It has been installed in the following cities, among others: Hamburg, Altona, Bremen, Chemnitz, Frankfurt-am-Main, Kassel, Offenbach-am-Main, Pforzheim, and Worms.

[18] Police Lieutenant-Colonel Voit, "Teleprinter Network of the Berlin Police Administration," *Electrical Communication,* Vol. XI, No. 1 (July, 1932).

the expense involved in its operation. Every precinct and telegraph service station required the services of three specially trained operators, making a total of about 1000 men so employed throughout the city. It was inevitable, therefore, that the police telegraph should be replaced by the far more efficient teletypewriter in the general modernization of the entire communication system in 1926.

The Berlin teleprinter installation closely parallels the police telephone system, the central exchange switchboard being installed at the headquarters of the uniformed force. This exchange is equipped with 40 trunk lines to provide individual and group connections with the 15 subexchanges in the police department and facilities for direct printer connection with the telegraph headquarters of the *Reichpost* and the fire department. Since the main cables of the police teleprinter system are leased from the *Reichpost,* it was a simple matter to provide for teleprinter connection between the Berlin police and all other police departments so equipped, through the facilities of the *Reichpost.* Ten machines for sending and receiving messages, including a high-speed transmitter and a tape perforator, complete the equipment of the central office.

Fifteen subexchanges are installed in the divisional and inspection offices of the department. Where these offices are not adjacent, they are connected by special trunks. To each subswitchboard are connected the divisional office teleprinter equipment and the machines in every precinct station of that division. Including the police stands in railroad stations, a total of 260 police stations can be reached through the teleprinter network.

The operation of the system is, of course, determined by its physical connections. Traffic within an inspector's district is conducted through the subexchange of that district. Provision has been made for sending individual or group messages. An inspector can send an order simultaneously to all the precinct stations in his district, or an important message may be transmitted from a precinct station to all other stations in its district and to neighboring districts. Connection

between two inspection districts is established through the principal exchange, but, in order to relieve the trunk lines between headquarters and districts, direct cross-connections between different inspection offices are also made. Messages may be sent from any subexchange to all other stations, although this ties up the network and is only resorted to in extraordinary situations. Usually a general alarm goes out from headquarters through the high-speed transmitter, so that the network may be free with a minimum of delay for routine traffic. Such general-alarm messages are first perforated on a tape which passes through the transmitter at a rate of 360 letters per minute.

It has already been mentioned that, for reasons of economy and flexibility, the cables and lines for the teleprinter system were rented from the *Reichpost*. At present, the lines between the precinct stations and inspection bureaus are used for telephone as well as teleprinter traffic, thus giving the police an additional telephone channel at no cost. In the future, it is intended to extend this duplicate use of the wires throughout the system.

In the teleprinter service, the Berlin police employ Lorenz tape printers almost exclusively. The communication officials recognize, however, that page printers are preferable for broadcasts to all stations, for they can reproduce a greater number of copies of the message. Substitution of page for tape printers can easily be made, since both types of machine may be employed at random in the same network. It is also possible to operate the teleprinter machines without land-wire connections, by means of radio. Although radio teleprinter service is not used frequently in Germany as yet, long experimentation and research by the commercial firms manufacturing the equipment, in coöperation with the laboratory of the *Polizeischule für Technik und Verkehr,* at Berlin, have resulted in the perfection of the apparatus used for this purpose, so that it meets the conditions of absolute reliability demanded in police communication. There is little doubt that the further expansion of the teleprinter network in Germany

will result in the general introduction of radio teleprinters to replace land-wire systems. This innovation will increase enormously the flexibility and range of the system.

Aside from the many advantages which the teleprinter has in police service, the Berlin installation strikingly demonstrates the economy of this type of communication in comparison with the old telegraph system. Instead of the 1000 special telegraph operators required to man the telegraph, only 24 special men are necessary to handle the heavy traffic over the teleprinter network. The headquarters exchange alone receives a monthly average of about 7500 messages and transmits approximately 3200 in addition to establishing about 4200 cross-connections. This great saving in operating personnel is possible because reception on a teleprinter does not require the presence of an attendant.

Police radio in Germany.—The Berlin police department occupies a unique and outstanding position in the field of police radio. Not only was radio equipment installed for the use of the department itself at the time of the general reorganization of the communication system, but the Berlin police radio station also serves as the radio transmitting central of a national police radio net which includes most of the cities of Germany. The Berlin station was, moreover, chosen to serve as the central radio station for the International Police Radio network, which began to function in 1929. No other police department in the world possesses a radio installation of such wide scope and importance, serving, as this one does, three purposes: as a local, a national, and an international medium of communication.

The principal use of radio in German police practice, unlike that of the United States, is as a means for intercity and long-distance communication. When one considers the comparatively small area and dense population of the German Reich and the number of large cities within its borders, the importance and volume of intercity police-communication traffic can easily be grasped. Because of its speed, its adaptability to broadcast, and its economy as compared to the cost

of telephone and telegraph traffic, radio became the most desirable means of communication between the various police departments of Germany.

To meet this need, a police radio network including almost all the cities of Germany has developed since the World War. The main police radio installation of the Berlin department, at Adlershof, serves in a certain measure as the radio transmitting central for all Germany. It is equipped with a 5-kilowatt automatic transmitter, in which the high-frequency current is generated not through tubes, as in the conventional broadcast transmitter, but through a high-frequency alternater. Situated at the principal points in the German network are so-called control stations which span a district and which are equipped with 300-watt transmitters. These stations maintain contact with the numerous police radio stations in their district, which operate with 25-watt transmitters.

At the Congress of the International Criminal Police Commission which met at Berne in 1928, the German delegation suggested the formation of an international police radio system which should include all the countries in Europe.[19] This suggestion was acted upon favorably and by November 15, 1929, a European police radio-communication network was placed in operation. Although it was hoped at the time of its formation that all the countries in Europe would join the system by 1931, only Germany, Austria, Poland, Czechoslovakia, and Hungary were participating in that year. Several other nations were well advanced in their preparations for entering the organization, however, and France, Belgium, Rumania, and Jugoslavia were expected to become members within a short time.

The central radio station controlling the entire system is in Berlin. Each country is equipped with a control station for its own internal system and may erect as many other wireless stations as it considers necessary. In frontier districts, where many international messages are exchanged, additional so-

[19] See Police Lieutenant-Colonel Voit, "International Police Radio," *Police Journal* (London), Vol. IV, p. 467 (1931).

called frontier stations may be installed, which transmit directly from one to another. A system of this kind operates between Munich, Germany, and Salzburg, Austria.

Aside from the traffic through frontier stations, all communications through the international radio system must come from the respective control stations of each country. Thus, in a country possessing several wireless stations, every message intended for international transmission must first be given to the central station, which in turn will route the message through the international system. The central stations, similarly, arrange for the circulating of all incoming messages intended for certain specified police stations in the country concerned. If there is no radio station at the police headquarters, messages intended for the International Radio will be conveyed by the quickest means, either by telegraph or telephone, to the nearest broadcast station ; messages destined for places which do not possess radio receivers are forwarded in a similar way. For the present, certain specified times are appointed for the transaction of international wireless communication, but where necessary these times may be extended at will. Control stations are open for half an hour every three hours from 6 :00 A.M. to 12 :30 A.M., for the transmission of business over the system.

Messages transmitted over the international network are of two kinds, termed i.p. and i.p.c.q. (i.p. signifies International Police Radio Message ; c.q. is the call sign for a general broadcast). The i.p. messages are those intended for a definite address, as, for example, the Police President at Vienna. In emergencies, these messages may be transmitted directly through the proper control station by any wireless station belonging to the police radio system. The i.p.c.q. are messages intended for general transmission. These messages must be forwarded to the central wireless station in Berlin, by wireless, telegraph, or telephone. The Berlin station transmits i.p.c.q. messages at certain scheduled times—for the present, twice daily, at noon and at midnight—and they are received by all countries included in the network. If the communica-

tion is intended for certain countries only, notification of that fact is given before the message is broadcast, as, for example, "For Austria and Poland only."

Four advantages of the international radio network are noted by an English police official. First, it meets the need for speedy communication arising out of the criminal use of automobiles and airplanes for rapid transit across national borders. Second, it enables the police of various countries to communicate directly with one another without the delay occasioned by sending through the postal services telegrams which, after being retelegraphed, copied, and checked, may take several hours to reach their destinations. Third, wireless communication has the advantage that news transmitted by one station may be heard by several stations simultaneously. Secrecy is attained through the use of coded communications. Fourth, the international radio net provides a very economical means of communication, in contrast with the cost of telegraph service. The equipment needed to participate in the service is a short-wave transmitting station and receiver. This outlay is counterbalanced by savings in telegrams. Moreover, if only i.p.c.q. service is desired, a receiver only is required. Countries which possess no wireless stations can telegraph police messages for retransmission to the radio headquarters at Berlin. Switzerland and other countries already make frequent use of this privilege. A fifth advantage, accruing from the four enumerated by Lieutenant-Colonel Voit, is the unification of police service on a scale which transcends state boundary lines, removing the fetters of a political hurdle which today handicaps the police the world over. Thus, even abroad where international rivalries might be calculated to retard such development, the promises of the regional police communication system have been definitely recognized.

Wireless telephotography.—At the Radio Exposition held in Berlin in 1928 there were displayed, among other police radio apparatus, machines for sending and receiving pictures by radio. Manufacturers of the equipment urged upon the police the installation of a telephotographic system, which,

according to the plan, would parallel the international radio net. A picture transmitter and receiver would be installed in the central police radio station at Berlin, and other receivers and transmitters would be placed at strategic points. Less important locations would be equipped with receivers only. By means of this system, warrants, fingerprints, photographs, and important documents could be sent out in a brief time to all the police stations, where they would be received on the machines as positive pictures.

The police were interested in the suggestion and undertook an extended program of research into the problems arising from the application of radio-telephotography to police service. As a result of this study, stations for experimental picture intercommunication were built at Berlin and Breslau, and receiving instruments were installed at Kassel, Frankfurt, and Kiel. Officials expect that expansion of the system will include all stations in the present international police radio system.

Police communication in other German cities.—The development of so excellent a police communication system in Berlin should not give the impression that all German cities are so well equipped. In fact, no other city in Germany can boast of a communication system so complete as that of the capital. Dresden (630,000 population), typical of the normal German city, is divided into 31 police precincts, each with a police station. A special telephone system, independent of the German *Reichpost,* connects police headquarters (*Polizeipräsidium*) with the precinct offices. As in Berlin, the commanding officer at headquarters can, by operating a special device, be connected with all the 31 precinct stations at the same time. When this central apparatus is put in operation, all other telephone connections which may exist between headquarters and the stations are broken, and the entire telephone network is at the disposal of the commanding officer.

No police-box telephone and recall system has been installed in Dresden to provide communication between precinct headquarters and beat patrolmen. Precinct officers get in touch

with their policemen by using the police whistle, or by calling a private telephone along the route that the particular officer is patrolling.

Although a teletypewriter system would prove invaluable as a communication medium between headquarters and the precinct stations and, through the *Reichpost,* with the police departments of other cities, the installation of this apparatus has been postponed for lack of funds. No local radio-transmission system is employed for sending messages to radio-equipped police cars. The Dresden police, like those of most other German cities, do have, however, a radio station which is a part of the German police radio net, and which is used to send and receive messages from Berlin and other cities of the Reich.

The banks of the city are equipped with burglary and robbery alarms wired direct to the police stations. The pressing of a button or other device sets off the alarm and summons the flying squad. Some years ago, an effort was made to introduce a general burglar-alarm system throughout the city, which would provide protection for householders and business establishments generally, as well as for banks and other similar institutions. Although, for lack of funds, this plan was not carried out at the time, there is a possibility that the system will be placed in operation in the near future.

To conclude that the police forces of the world are in a fair position to meet today's responsibilities, would not be in strict accordance with the facts, yet the foregoing summary shows evidence of an awakened interest in progress and of the application of scientific methods to the requirements of modern police service. Following the demands of a war which in 1914 and succeeding years engulfed all the major Powers of the earth, there has been a revival of national interest in the problems at home. In police service, this has led to a recognition of the need for modern forces, modern equipment, and modern methods of operation to match the criminal of today. Communication is world-wide in its significance to the policeman. Whether it be Morocco, Siam, or the state of Connecti-

cut, the problem remains essentially the same—the design of a system of communication accommodating the receipt of crime reports and information, and means for radiating this intelligence to members of the force. In the solution of this and collateral problems, the nations are forging ahead toward the final consummation of two major police projects, crime prevention and crime suppression.

Chapter XIV

CONCLUSION

Modern communication systems are now well within reach of almost all police budgets; nevertheless the percentage of police departments in the United States that are adequately equipped with this important facility is so low as to constitute some cause for alarm. The connection between the niggardly communication resources of American police departments and the prevalence of crime in this country is no mere speculation: it is a stark reality.

From statistics of the Census Bureau, recent surveys, and general observation, one should be convinced that adequate communication facilities are yet lacking in many towns and cities in the United States. Significant data were collected by the Census Bureau for a number of years, the latest report being for the year 1917, which disclosed that, of the 15,194 incorporated places in the United States,[1] only 428, or 2.82 per cent, reported the possession of electric police-alarm systems. Of these systems, 383 were solely for police work and 45 were joint police and fire-alarm installations.

Because of the assumed ease of policing the small community without a beat telephone and recall system, and because of the fact that 12,550 of the total number of incorporated places were incorporated rural areas of less than 2500 population, it may be urged that the situation was not so serious as this percentage would indicate. This objection is hardly tenable, for it is the consensus among the best authorities that no community, of whatever size, can be properly policed in the absence of some form of reporting and recall system. Even in a village of fifty inhabitants, where a night watchman or constable may be the sole agent of law enforcement, some method of recall would be important. In fact, the smaller the

[1] The figures in respect to cities of various sizes in the United States in 1917 were obtained by interpolating from the Census figures of 1910 and 1920, and assuming a uniform annual increment.

force the more imperative it becomes to compensate for the lack of personnel by the installation of suitable material equipment. The population size of a village or municipality has little or nothing to do with the advisability of adequate communication facilities. Population operates as a factor only in the determination of the type or elaborateness of the installation.

Even if it were assumed that no city under 2500 population needed a police-box and recall system, the situation in 1917 was discouraging, for but 16.19 per cent of the 2644 cities of 2500 population and over could have had such systems. Assuming that none of the 428 systems then in operation were installed in cities of less than 5000 population, there would still have been only 30.84 per cent of the 1388 cities of 5000 population and over which boasted such systems. Thus the data show that, in 1917, not only 97 per cent of all incorporated places, both large and small, were handicapped, but also 40 per cent of the larger urban centers in the United States were inadequately policed because they lacked these essential communication facilities. The general results of the investigation in 1917 disclosed so deplorable a state of affairs with respect to the distribution of police communication facilities, that it would have been almost impossible to improve conditions to a satisfactory level in the fourteen years preceding a notable survey of American police systems in 1931.[2]

In this critical study, a survey was made of 954 communities varying in population from under 10,000 to 500,000 and more. Inadequacy of equipment was again tragically apparent in the small town. In the main, these countless little urban areas exist in a very carefree fashion. In the years of their former isolation, their sole problems were jailing a few inebriates, catching stray dogs, and similar duties. Today, with concrete highways stretching in every direction, they must combat the traffic problems and many of the vices which affect the larger city. With a police force of one or two men, or not

[2] *Report of the Law Observance and Enforcement Committee* (Chicago, 1931).

over half a dozen, it is impossible for them to cope adequately with new situations which are constantly arising. Nevertheless, the widespread opinion persists that, in the smaller cities, police communication facilities are not needed and that the expense of the equipment would not be justified. Meanwhile, the notorious increase of crime in the smaller centers is emphasizing daily the great need for this equipment. Criminals are finding it increasingly convenient to select the small towns and communities as points of attack, returning to their rendezvous in the city for cover.[3] The personnel of the police departments in these small municipalities even today is usually too limited to be able to compensate in man power for the lack of equipment, and experience has abundantly shown that such a policy proves more expensive in the end and that the attempt to reduce police expenses by neglecting communication facilities is costly economy.

In a personal survey of 225 communities of this class (up to 10,000 population), the Committee discovered that 207 possessed no signal equipment whatsoever. Among communities ranging in population from 10,000 to 30,000, a lack of adequate call boxes was still much in evidence: of the 246 cities in this class, only 144 used them; 109 did not use recall lights, and only 108 were equipped with bell or horn. Less than 45 per cent could be said to possess adequate box facilities. In most communities, from the time the patrolmen left the station until they returned, they were lost to the department. The larger the size of the town and the greater the population, the more acute the lack of available man power becomes. To the inhabitant, the only available policeman in an emergency is the man at the station; and towns of this group can rarely afford to keep more than one or two men permanently at the station.

Thirteen of the 68 cities in the 30,000 to 50,000 population group still remained unequipped with an adequate recall system. Of the 55 which used boxes, 36 possessed lights aligned with the boxes, and 25 had lights aligned with bells or horns.

[3] See *Report of the Illinois Bankers Association on Bank Robbery.*

Again, less than 50 per cent could be said to be efficient. Of the fourth group, including cities up to 100,000 population, 3 of the 25 had lights aligned with bells or horns. Again, less than 50 per cent could be said to be efficient. Of the fourth group, including cities up to 100,000 population, 3 of the 25 had neither call boxes nor signal lights. Of the 22 cities so equipped, 9 had recall-light signal facilities and only 6, bell or horn. This group boasted a box efficiency of 25 per cent. All cities in excess of 100,000 population employed the beat telephone, and all but two of them were equipped with recall lights, horns, or bells.

Among the 390 cities of more than 10,000 population, 14,296 police boxes were reported in use, and in the opinion of the chiefs of police, 11,731 more were needed; 109 recall bells were in service, 9775 more were held necessary; 213 colored signal-light units were in operation, 1505 more were required.

In order to obtain more recent information for the present work a communication questionnaire was forwarded in May, 1933, to 1562 American police departments in cities ranging in population from 5000 to 1,000,000 and more. Tabulated returns from this survey (see pages 465–471) confirm the findings of the Law Observance and Enforcement Committee and draw attention to the character and distribution of communication equipment in use by the police of the United States today.

From the tables on pages 465–471 the reader may draw his own conclusions concerning the opportunities that lie ahead for an expanding use of modern communication equipment in police service. Although the 480 replies received represent only 30.69 per cent of the total number of communities of 5000+ population in the United States, the information may be considered representative in view of its wide territorial coverage. Complete returns would have reduced to a marked degree the percentages quoted, since it is safe to assume that communities not equipped with modern police communication facilities were, the majority of them, among those failing to answer the questionnaire. This assumption is veri-

Distribution of Police Communication Equipment in the United States, According to Population Groups

Population group	Number in United States	Answers to questionnaire		Beat telephones		Signal lights		Signal horns or bells		Other recall devices		Radio transmitter		Radio patrol cars		Radio-equipped motorcycles		Teletype machines		Connection with state-regional teletype system	
		Number	Per cent	Number	Per cent*	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
1,000,000 or over	5	4	80.00	4	100.00	2	50.00	2	50.00	2	50.00	4	100.00	4	100.00	0	0.00	3	75.00	3	75.00
500,000 to 1,000,000	8	7	87.50	6	85.71	6	85.71	2	28.57	0	0.00	6	85.71	6	85.71	3	42.85	6	85.71	4	57.14
250,000 to 500,000	24	12	50.00	9	75.00	5	41.67	5	41.67	2	16.67	11	91.67	11	91.67	4	33.33	6	50.00	3	25.00
100,000 to 250,000	56	19	33.92	18	94.21	11	57.89	9	47.36	4	21.05	9	47.36	9	47.36	3	15.79	8	42.15	7	36.84
50,000 to 100,000	98	44	44.89	37	84.09	25	56.82	18	40.99	1	2.27	10	22.72	18	40.99	2	4.54	12	27.27	11	25.00
25,000 to 50,000	185	81	43.78	62	76.54	56	69.01	28	34.57	13	16.05	5	6.17	12	14.81	1	1.23	16	19.75	15	18.52
10,000 to 25,000	606	245	40.43	156	63.67	118	48 16	49	20.00	42	17.14	6	2.44	†	†	†	†	31	12.65	31	12.65
5,000 to 10,000‡	851/582	68	11.68	24	35.29	34	50.00	6	8.82	21	31.62	0	0.00	†	†	†	†	1	1.47	1	1.47
Totals	1564	480	30.69	316	65.83	257	53.54	119	24.79	85	17.71	51	10.63	60	35.93	13	7.66	83	17.29	75	15.63

* Percentage, except in answers to questionnaire, indicates percentage of cities answering which have certain equipment.

† Data on radio patrol equipment not obtained for cities of less than 25,000 population.

‡ Of the 851 cities of this size in the United States, questionnaires were sent to only 582.

Total of cities in United States to which questionnaires were sent..... 1564
Total of answers received..... 480
Percentage of answers received..... 30.69

DISTRIBUTION OF POLICE COMMUNICATION EQUIPMENT IN THE UNITED STATES, ACCORDING TO GEOGRAPHICAL AREAS

Area	Number of cities in United States with population 5,000 and over	Number of cities questioned*	Answers to questionnaire		Beat telephone		Signal lights		Signal horns or bells		Other recall devices		Radio transmitter		Teletype machines		Connection with state or regional teletype		Radio patrol equipment				
																			Cities‡ questioned	Answers			
																				Radio cars		Radio motors	
			Number	Percentage of cities sending answers	Number	Per cent†	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	System number	Per cent	Number	Number	Per cent	Number	Per cent
New England	201	151	50	33.11	49	98.00	32	64.00	15	30.00	5	10.00	3	6.00	13	26.00	13	26.00	29	6	20.69	0	0.00
Middle Atlantic	432	376	96	25.53	71	73.85	55	53.02	30	30.21	13	13.44	6	6.25	49	51.04	47	48.96	27	6	22.22	0	0.00
East North Central	404	344	119	34.59	80	67.23	66	55.46	28	23.53	23	19.33	12	10.08	7	5.88	4	3.36	46	19	41.30	3	6.52
West North Central	171	147	55	37.42	28	50.91	23	41.82	9	16.36	13	23.64	9	16.36	2	3.64	3	5.45	16	8	50.00	6	37.50
South Atlantic	179	155	31	20.00	18	58.06	9	29.03	8	25.81	5	16.13	2	6.45	1	3.23	0	0.00	14	1	7.14	0	0.00
East South Central	93	82	18	21.95	8	44.44	4	22.22	5	27.78	4	22.22	4	22.22	1	5.56	1	5.56	9	4	44.44	2	22.22
West South Central	157	131	24	18.32	8	33.33	9	37.50	8	33.33	4	16.67	6	25.00	1	4.17	1	4.17	6	5	83.33	2	33.33
Mountain	66	63	25	36.51	11	44.44	16	64.00	7	28.00	5	20.00	2	8.00	3	12.00	2	8.00	6	2	33.33	0	0.00
Pacific	131	115	62	53.91	43	69.35	43	69.35	9	14.52	13	20.98	7	11.29	6	9.68	4	6.45	14	9	64.28	0	0.00
Totals	1834	1564	480	30.69	316	65.83	257	53.54	119	24.79	85	17.71	51	10.63	83	17.29	75	15.63	167	60	35.93	13	7.66

* Questionnaires were sent to all cities of more than 10,000 population, and to 582 of the 851 cities with population of 5,000 to 10,00.

† Percentage indicates percentage of those cities answering which are using equipment.

‡ Cities of less than 25,000 population were not questioned concerning radio patrol equipment.

DISTRIBUTION OF POLICE MOTOR EQUIPMENT ACCORDING TO POPULATION

Population group	Number cities in United States	Answers to questionnaire		Patrol cars		Motorcycles	
		Number	Per cent	Number	Per cent*	Number	Per cent*
1,000,000 or over	5	4	80.00	4	100.00	4	100.00
500,000 to 1,000,000	8	7	87.50	7	100.00	7	100.00
250,000 to 500,000	24	12	50.00	10	83.33	10	83.33
100,000 to 250,000	56	19	33.92	17	89.47	18	94.73
50,000 to 100,000	98	44	44.89	43	97.74	44	100.00
25,000 to 50,000	185	81	43.78	77	95.06	67	82.72
10,000 to 25,000	606	245	40.43	220	89.80	182	82.73
5,000 to 10,000	851/582†	68	11.68	64	95.30	29	42.65
Totals	1564	480	30.69	442	92.08	361	75.63

* Percentage in these columns indicates percentage of those cities answering questionnaire that are using patrol cars and motorcycles.

† Of the 851 cities of this size in the United States, questionnaires were sent to only 582.

DISTRIBUTION OF POLICE MOTOR EQUIPMENT IN THE UNITED STATES ACCORDING TO GEOGRAPHICAL AREA

Area	Number cities in United States, population 5,000 and over	Number cities questioned*	Answers to questionnaire		Patrol cars		Motorcycles	
			Number	Per cent	Number	Per cent†	Number	Per cent†
New England	201	151	50	33.11	46	92.00	41	82.00
Middle Atlantic	432	376	96	25.53	85	88.54	78	81.25
East North Central	404	344	119	34.59	111	93.28	92	77.31
West North Central	171	147	55	37.42	50	90.91	33	60.00
South Atlantic	179	155	31	20.00	28	90.32	25	80.65
East South Central	93	82	18	21.95	16	88.89	13	72.22
West South Central	157	131	24	18.32	22	91.67	18	75.00
Mountain	66	63	25	36.51	23	92.00	15	60.00
Pacific	131	115	62	53.91	61	98.39	46	74.20
Totals	1834	1564	480	30.69	442	92.08	361	75.63

* Questionnaires were sent to all cities of more than 10,000 population; and to 582 of the 851 cities with population of from 5,000 to 10,000.

† Percentage in these columns indicates percentage of those cities answering questionnaire that are using patrol cars and motorcycles.

DISTRIBUTION OF BANK AND MERCANTILE ALARM SYSTEMS IN THE UNITED STATES ACCORDING TO POPULATION GROUPS

Population groups	Number cities in United States	Answers to questionnaire		Bank alarms		Mercantile alarms		Alarms connected direct with police department	
		Number	Per cent	Number	Per cent†	Number	Per cent†	Number	Per cent†
1,000,000 or more.....	5	4	80.00	3	75.00	2	50.00	2	50.00
500,000 to 1,000,000....	8	7	87.50	5	71.46	3	42.86	5	71.46
250,000 to 500,000.....	24	12	50.00	9	75.00	4	33.33	6	50.00
100,000 to 250,000.....	56	19	33.92	13	68.42	8	42.11	9	49.49
50,000 to 100,000.....	98	44	44.89	38	86.34	25	56.82	28	63.41
25,000 to 50,000.....	185	81	43.78	71	87.65	40	49.38	44	54.32
10,000 to 25,000.....	606	245	40.43	219	89.39	99	40.41	‡	‡
5,000 to 10,000.....	851/582*	68	11.68	57	83.82	25	36.76	‡	‡
Totals.....	1564	480	30.69	415	86.46	206	42.92	94‡	56.24

* Questionnaires were sent to only 582 of the 851 cities of this size in the United States.

† Percentage in these columns indicates percentage of cities answering questionnaire reporting bank and mercantile alarms and police connection.

‡ Cities of less than 25,000 population were not questioned concerning police connection.

DISTRIBUTION OF BANK AND MERCANTILE ALARM SYSTEMS IN THE UNITED STATES ACCORDING TO GEOGRAPHICAL AREA

Area	Number cities in United States, population 5,000 and over	Number cities questioned*	Answers to questionnaire		Bank alarms		Mercantile alarms		Alarms connected direct with police department	
			Number	Per cent	Number	Per cent†	Number	Per cent†	Number	Per cent†
New England.....	201	151	50	33.11	42	84.00	15	30.00	16	32.00
Middle Atlantic.....	432	376	96	25.53	87	90.63	45	46.88	12	8.33
East North Central..	404	344	119	34.59	108	90.76	59	49.68	29	24.36
West North Central..	171	147	55	37.42	49	89.09	24	43.64	13	23.64
South Atlantic.....	179	155	31	20.00	23	74.19	7	22.58	8	25.80
East South Central..	93	82	18	21.95	16	88.89	6	33.33	3	16.67
West South Central..	157	131	24	18.32	16	66.67	15	62.50	1	4.17
Mountain.....	66	63	25	36.51	22	88.00	10	40.00	3	12.00
Pacific.....	131	115	62	53.91	52	83.87	25	40.32	9	14.52
Totals.....	1834	1564	480	30.69	415	86.46	206	42.92	94‡	56.29

* Questionnaires were sent to all cities in the United States with a population of 10,000 and over; and of the 851 cities with population of from 5,000 to 10,000, questionnaires were sent to 582.

† Percentage in these columns indicates percentage of cities answering questionnaire reporting bank and mercantile alarms and police connection.

‡ Cities less than 25,000 population were not questioned concerning police connection.

fied by the fact that interest in the subject seemed to be directly proportional to population, the percentage of returns showing a steady decline from 80 per cent for cities of 1,000,000+ inhabitants, to 11.68 per cent for municipalities of from 5000 to 10,000 population.

Facts such as these must be faced by the authorities responsible for the protection of life and property in the United States. The people of the country are becoming aware of the large burden of crime costs which they are annually forced to

PREFERENCES WITH RESPECT TO POLICE CONNECTION OF BANK AND MERCANTILE ALARM SYSTEMS

	Number of cities	Per cent
Number of cities to which questionnaires were sent...	1564	
Cities answering questionnaires.....	480	30.69
*Opinion requested of.....	167	
Direct connection with police department preferred by	96	57.49
Connection with precinct station preferred by.....	4	2.40
Connection with private company preferred by.....	5	2.99
Connection with all three agencies preferred by.....	5	2.99
Headquarters or precinct station equally acceptable to	8	4.79

* Only cities of more than 25,000 population were asked their opinion on police connection.

bear.[4] If, as some assert, certainty of apprehension and punishment would result in a more effective control over crime, increased expenditures for police communication facilities—without which speedy and certain apprehension of criminals is almost impossible—become an immediate obligation of municipal, county, and state governments. Those who do not take so simple a view as this of the causes and cure of crime would also approve of increased facilities for apprehending lawbreakers; for, no matter what one's theory of the causes of crime and the treatment of criminals may be, apprehension must continue to be the first step in any process of punishment, reformation, or treatment.

Expenditures for an adequate police communication sys-

[4] See the *Report of the National Commission on Law Observance and Enforcement,* on the "Cost of Crime."

POLICE COMMUNICATION AND MOTOR EQUIPMENT: DISTRIBUTION OF ACTUAL PIECES OF EQUIPMENT ACCORDING TO POPULATION

Population group	Number cities answering	Beat phones	Signal lights	Signal horns	Teletype machines	Patrol cars	Motor-cycles	Radio patrol cars	Radio motors	Bank alarms	Mer-cantile alarms	Alarms connected to police depart-ment
1,000,000 or over.....	4	4816	671	91	217	1160	575	680	0	420	20	307
500,000 to 1,000,000....	7	3132	2402	711	122	584	371	346	5	206	30	209
250,000 to 500,000.....	12	1264	755	326	42	351	197	424	50	68	110	35
100,000 to 250,000.....	19	845	342	167	11	123	206	118	18	110	131	68
50,000 to 100,000.....	44	1520	695	297	11	238	297	126	3	165	170	125
25,000 to 50,000.....	81	1344	758	319	18	204	199	41	2	246	275	138
10,000 to 25,000.....	245	1568	*	*	*	221	327	*	*	500	533	*
5,000 to 10,000.....	68	175	*	*	*	41	42	*	*	99	186	*
Totals.....	480	14,664	5623	1911	421	2922	2214	1735	78	1814	1455	882

* Cities of less than 25,000 population were not questioned about the actual number of pieces of equipment used.

Police Communication and Motor Equipment: Distribution of Actual Pieces of Equipment According to Geographical Area

Area	Number cities answering	Beat phones	Signal lights	Signal horns	Teletype machines	Patrol cars	Motor-cycles	Radio patrol cars	Radio motors	Bank alarms	Mercantile alarms	Alarms connected to police department
New England	50	1562	566	64	32	178	242	38	0	163	166	86
Middle Atlantic	96	3783	1088	860	165	1008	624	427	0	303	324	100
East North Central	119	5295	1725	368	86	653	498	707	24	820	348	520
West North Central	55	1192	778	31	27	323	168	116	23	153	140	40
South Atlantic	31	424	498	120	12	164	138	19	0	103	18	67
East South Central	18	218	157	1	9	143	108	99	24	61	101	22
West South Central	24	137	99	99	1	75	84	83	7	30	49	1
Mountain	25	183	38	16	2	74	41	53	0	45	73	20
Pacific	62	1870	674	352	87	304	311	193	0	127	236	26
Totals	480	14,664	5623	1911	421	2922	2214	1735	78	1805	1455	882

tem can be defended upon the grounds of its tactical value to the police force and its economy to the community. It is well to bear in mind that police operations and field technique are of the nature of a military engagement in time of war. Strategy and tactics employed by the police are essentially those of the military force, since both police and military operations are directed against a hostile element bent upon an attack against life and property. The theater of police activities is one of combat in which engagements are real, and in which gunfire and the loss of life may characterize the day's work. Military maneuvers, reconnaissance, and maintenance of communication lines between the elements of a command in military campaigns, all find their counterpart in the patrol operations of a well-organized police department, where success is primarily dependent upon the expert use of a limited number of men.

Rear-Admiral Fiske has formulated the rule for determining the effectiveness of two forces in combat. Assume that one force is numerically superior to the other, in the ratio of 1000 to 500, and that the destructive ability per man, 10 per cent, is the same in each force. In other words, one man will be put out of action by each ten men of the respective forces in each engagement. In the first engagement the larger force will inflict a damage of 10 per cent of its own numbers, or 100 men, on the smaller; and the smaller will inflict a loss of 50 on the larger. The relative losses and the number of engagements required to annihilate the smaller force, other things being equal, are shown below in the accompanying table (p. 473).

In the entire six engagements the destructive power of the individual men in each force is exactly the same. If, in the smaller force, we increase maneuverability and speed of action, the destructive power of the individual unit is greatly enhanced through the application of a simple principle of mechanics, namely, the value of mass times rapidity of movement. If increased from ten to twenty, the smaller force of 500 becomes as powerful as the larger contingent and, beyond

that point, complete annihilation of the greater force is a certainty.

In a strictly numerical consideration, the police force is at a tremendous disadvantage. The number of professional criminals and their amateur brethren, together with the random and potential offenders, may outnumber the patrol force in any one community by a ratio of from 500 : 1 to 2000 : 1. Add to this the fact that the time and place of criminal attack is known in advance only to the offender, and some idea of the

EFFECT OF SUPERIORITY OF FORCE

Engagement	Larger force (1,000)		Smaller force (500)	
	At opening of engagement	Loss	At opening of engagement	Loss
First	1,000	50	500	100
Second	950	40	400	95
Third	910	31	305	91
Fourth	879	21	214	88
Fifth	858	13	126	86
Sixth	841	4	40	40
Sixth surviving	841		0	

magnitude of the patrol problem may be gained. In riots, major disturbances, and outbreaks, the police force is responsible for the restoration of order, and where mob violence gains the upper hand, this deficiency in numbers may make control of the situation difficult if not impossible, unless the best of strategy and equipment is employed. It is at once apparent that an enormous gap must be bridged over if the power of an incredibly small force is to be amplified up to a point where operations will be attended with any degree of success.

In building up the combat strength of the patrol force, two principles of military strategy are today at work in modern patrol service. Separately, they appear to be contradictory and in conflict with each other. Together, and with the aid of communication, they have made possible the dual responsibility of the twentieth-century patrolman to society, namely,

that of an agency for the prevention and detection of crime on the beat, and as a unit of reserve strength instantly available for mobilization in emergencies.

The first of these principles, deployment of the force, finds expression as a function of the definite limits imposed upon the personnel strength of a police department by the demands of efficiency and economy. The law of diminishing returns reveals a steady decline in both efficiency and economy when total personnel passes a certain point. There is likewise a steady decrease and even eventual loss of all efficiency, when, through the dictates of a specious, dangerous economy, the police force is inadequate in numbers to master the situation. This certain existence of a definite, known limit to available man power being authoritatively determined, expert organization and distribution of the strength that is available is imperative. Thus decentralization of the force has come to be a fundamental principle of police organization, by virtue of which the police beat is the foundational unit of operation in the modern department. The beat patrolman is the final outpost of a crime-fighting organization. While in normal routine patrol of his beat, he is also discharging the greater part of the basic functions of police service and protection, as leading criminologists have observed. Decentralization permits the maximum employment of man power and equipment.

The second tactical principle, upon which is predicated police mobilization in the emergency, is conservation of the reserve strength of the force. It is fundamental in military strategy that every field maneuver must be supported from the rear by a reserve force. In police service, this provision for reserve strength is an indispensable part of the patrol system, for the police must be prepared, always and instantly, to meet any emergency.

Decentralization of the force, of course, is accompanied by a scattering of strength throughout the area policed, and superficially seems to imply a disruption of the reserve plan whereby a body of men may be immediately detailed to the scene of action when an emergency arises. Two possible alter-

natives may be considered. A standing reserve force may be held at headquarters, or in police stations, in readiness for concentration in any given quarter. For many years police departments maintained such a force, but as an administrative procedure the practice proved unsound and it has been, in large measure, abandoned. The plan was obviously uneconomical and inefficient because of the waste represented by idle man power and equipment in the intervals between emergency calls.

The remedy has rather been found in a second alternative whereby, through the agency of communication and the exercise of the powers of maneuverability and speed of movement, effective mobilization is possible, and at a moment's notice a highly decentralized machine may be transformed into a mobile unit capable of rapid concentration in any quarter. Whether the emergency be the investigation of a reported suspicious character in an outlying neighborhood or the response to a major bank alarm, the results are the same, the rapid and intelligent movement of required strength to the scene of action. Thus, through the simple formula—mass times rapidity of action—the power of a numerically inferior body of men is amplified to a point where they may adequately perform the tasks assigned to them.

Elementary though this principle may seem, it bears directly upon the police problem in every community today. Adequate communication facilities provide the only means that make it possible for the force to act as a unit. Without some means whereby the chief can keep in touch with his men, the isolated patrolman can seek assistance from headquarters, and both parties can communicate with each other, the entire force is paralyzed. The men are without a head to plan and the head is without a force wherewith to strike. Commenting upon the serious lack of police communication equipment in most communities, the Law Observance and Enforcement Committee in its notable report concerning police conditions in the United States, directed attention to the situation in the following words:

To serve the community effectively, the policeman must be fully equipped with the tools of his profession. This important item has been overlooked by the treasury watchdogs, who, in their eagerness to make a record for economy, have compelled the police to fight the criminal without aid of modern and necessary devices and appliances.

This is in essence one of the most serious of police ills which communities are facing today. To many, the number of personnel immediately connotes an efficient system. They do not seem to realize that organized gangdom, rapidly increasing population, and the consequently greater burden of handling it, plus swiftly expanding areas, must eliminate the idea once and for all that 1900 standards of police equipment and obsolete methods of communication can possibly effectuate a control over the menacing crime situation.

It is not yet fully realized by municipal authorities that the expenditure for an adequate police communication system is a profitable investment and one in which the returns are immediate and tangible. In the plan for an improved force, personnel considerations too often eclipse the real need, which is the need of equipment. The salaries of policemen run into millions, and represent the major part of the annual budget in each individual police department. Equipment which would increase the effectiveness and reduce the quantity of costly personnel resources would be cheap, even at the price of a considerable outlay. The money spent in providing efficient communication services gives a much greater return in improved protection than if used simply to add to existing man power. *The mere addition of more men does not in any way influence the effectiveness of the individual officer, nor does it increase to any appreciable degree the over-all protective work of the department as a whole.*

Almost every American police department today is complaining of a shortage of man power and besieging its municipal officials for budget increases to take care of proposed additions to the force. Closer inspection would reveal, in the greater number of departments, that the shortage is in equipment rather than in man power. In the ordinary large community in this country, the ratio of total police personnel to population in the area served is approximately 1:500. In contrast with this usual ratio, one modern police department

today, serving a total population of 85,000 people and properly equipped for its work, is effectively policing the area with a total personnel in the ratio of one officer to approximately 1750 population. Current Federal statistics indicate that this community has succeeded in establishing the lowest crime rate for all cities of comparable size in the United States. There are other communities which have thus discovered that, through the application of modern methods and equipment, they can determine their own crime rate.

The immediate and far-reaching economic significance of prompt arrest has not yet received the full recognition that it deserves. The striking relationship between delayed apprehension and the mounting costs of law enforcement, more particularly to the treasury of the individual municipality, is best exemplified by an analysis of a typical case removed from police records of the day.

Near the closing hour of business a well-dressed young man walked into a branch bank in a far western city and tendered a check for payment. As the cashier opened the money drawer, the erstwhile customer drew an automatic pistol, held up the bank, and escaped with $1500 in currency. The man committing this robbery proved to be a paroled convict from the California State Penitentiary at San Quentin. He was subsequently apprehended in Kansas City, some two thousand miles from the city in which the crime was committed. The bank was robbed on November 28, and the offender was taken into custody on December 13 following. Although only fifteen days had passed between the commission of the crime and the date of apprehension, it was no ordinary bill that the community had to pay as a direct result of the criminal's escape on November 28.

The analysis is concerned only with the expense incurred up to and including the time of arrest, since it is in that interval that an adequate bank hold-up alarm system and patrol-communication facilities might have effected an immediate arrest and resulted in the elimination of a greater portion of the cost of this case to the community. The additional cost of

prosecution, conviction, and penitentiary confinement is a matter of direct concern to students in other fields of criminology.

COST OF CASE

(1) Currency taken from bank, $1500, less $600 recovered on the person of the offender at the time of the arrest	$ 900
(2) Transportation and other expenses involved in extradition of the prisoner from Missouri	520
(3) Cost of investigation by Missouri police officials which led to his arrest	200*
(4) Investigation of certain aspects of the case by other outside police agencies, including the police departments of Los Angeles, Calif.; Chicago, Ill.; Hot Springs, Ark.; Galena, and Wichita, Kan.; Forest Park, Ill.; and Richmond, Calif.	650*
(5) Reward paid by bank officials to the Missouri police officials who took the offender into custody	1,000
(6) Correspondence, telegrams, and long-distance telephone conversations exchanged in the course of investigation	50
(7) Administrative, investigational, and clerical expense in the city where the crime was committed	350*
Total	$3,670

* Estimated.

Quick apprehension of the criminal in this case would have effected a direct saving of approximately $3300, an amount sufficient to finance the installation of a complete modern recall system in the ordinary city. Items Nos. 1, 3, 4, 5, 6, and part of 7 would have been eliminated entirely by a crime-scene arrest.

Attention is invited to the fact that the financial loss to the community in this particular case was below the usual amount. It is usually more, seldom less. The police were favored by the discovery in the preliminary investigation of a crumpled part of a letter in the robber's apartment which gave valuable information concerning his possible movements, a circumstance which eventually led to his arrest in Kansas City. Under ordinary conditions, as most police officials will testify, the investigation might easily have extended over a period of months, with the total cost of the case mounting rapidly.

Few persons stop to realize, particularly municipal officials who control the financial administration of their communities, that the successful escape of a criminal is inevitably followed by an extended and costly investigation, and that society—the community and the individual taxpayer—must perforce underwrite every dollar spent in the interval between escape and apprehension. Even less recognition is given to the inescapable fact that it is only through the provision of an adequate communication system that the arrest may follow close on the depredation.

The police department must be equipped to meet the criminal who, today, has utilized in his nefarious calling many of the achievements of science and modern civilization. Fast automobiles left conveniently unlocked at the curb by careless or trusting motorists or purchased outright with an illicit income, have solved his transportation problems. Networks of improved highways await the desperado, and chance favors his safe retreat unless the police are able to close every avenue of escape without delay. Given five minutes, the fugitive is from three to five miles away from the scene of his crime. Under the protecting cover of darkness he can be completely lost by the following morning in another city four hundred miles distant. In the foregoing case, typical of the daily repertory of crime, a stolen automobile provided the means for the get-away, and at Sacramento, some seventy-five miles from the scene of attack, the robber abandoned the car and boarded a fast plane for Chicago.

The financial economy of a modern police communication system is not limited to the savings made in individual cases. The gain is cumulative, expanding like compound interest. News travels rapidly in the underworld and professional criminals soon learn to give a wide berth to those communities where, as they know in advance, a fast police service awaits them. These fellows possess too keen a sense of prison humor to gamble with their liberty in the well-protected community; they look for easier prey, where the hazards of apprehension are not so great. Local offenders are even more easily con-

vinced, with the general result that the crime rate of the adequately policed community bends downward and the economic and social losses attributed to crime drop to a saner level. So close is the relationship between the cost of law enforcement and police preparedness for emergencies. With an annual crime bill now estimated to be approximately billions of dollars,[5] the communities of the nation cannot afford further to neglect the provision of adequate police operating equipment. If adequate recall, telephone, radio, and teletypewriter systems provided for the use of law-enforcement agencies saved one-tenth of 1 per cent of the nation's tribute to the criminal, their cost would be underwritten many times over.

The broad economical aspects of adequate police communication equipment have received recognition in one quarter, namely, the insurance companies. Burglar- and holdup-alarm protective systems have yielded substantial discounts in insurance rates for some time. There now appears the possibility that, in the computation of the rates of insurance covering all forms of criminal attack against property, consideration will be given to the relative standing of the individual police departments as crime-fighting organizations. Just as fire-insurance rates are influenced by the fire-fighting equipment of a community, there is a widening opinion that insurance rates for protection against automobile theft, robbery, burglary, fraud, and embezzlement should be based in some degree upon the measured efficiency of the community's police department and its equipment. Unofficially at least, insurance underwriters have proposed a conference between their number and a committee from the International Association of Chiefs of Police to consider such a project.

Under this plan, a percentage of the rate on the classes of insurance mentioned would be based upon efficiency factors, points to be deducted or credited to the basic percentage in accordance with the department's accredited standing. Progress in this direction will depend somewhat upon the

[5] Speech by Senator Royal S. Copeland, Thursday, January 11, 1934, *Congressional Record*, 73 Cong., 2 Sess.

development of a yardstick or some satisfactory system of measurement for the determination of a department's relative standing on the efficiency scale. Annual reports showing the amount of crime committed, number of arrests and convictions, and similar data, are indicative but not conclusive, and need to be supplemented by the many other important factors. This particular phase of the problem is receiving the attention of police experts at the present time, and it is likely that a measuring device or scale will soon be developed which can be applied to the department of any community in the country, and the standing or efficiency of that department definitely and accurately determined.

While any satisfactory rating system must of necessity be concerned, among other things, with the police executive, his method of appointment, training, and tenure of office; departmental personnel—qualifications, appointing procedure, training, sick benefits, pension provisions; detective bureau—organization and procedure; the police record system; traffic regulation and control; criminal identification methods in use; and similar factors, the nature and the extent of modern communication facilities at the disposal of the department will occupy a major position in any analysis. The number and the type of burglar- and holdup-alarm systems, beat telephone and recall systems, headquarters telephone layout, radio system, teletype connection, and the plan of operation for emergencies—these things will be far-reaching in their effect on insurance-rate adjustments.

This general development is to be welcomed; for the problem of inadequate police communication facilities, when thus linked to insurance rates on a broad scale, becomes a matter of immediate personal concern to every individual in the community, and a reaction toward increased allowances for operating equipment should be the logical, inevitable, and, it may be added, most desirable result.

With the case for communication resting solidly upon a foundation of both utility and economy, the dearth of modern equipment in use is a challenge to the police and to the author-

ities under whom they serve. Modern telephone, radio, teletype, and alarm equipment is now obtainable at costs which eliminate any just or reasonable complaint of excessive expenditure, and those charged with the conduct of municipal affairs will find it increasingly difficult to ignore their responsibility to the community in providing the police department with adequate operating equipment.

APPENDIX 1

Specifications and Bidding Instructions for the Purchase of Police Radio Equipment

Milwaukee.....

To the Central Board of Purchases,
City of Milwaukee.

The subscriber hereby proposes to furnish the material hereinafter described at and for the prices hereinafter named, according to plans and specifications on file in the office of the Central Board of Purchases, to-wit:

(a) Bidder shall quote here for furnishing the following equipment, radio transmitter and 8 receiving sets installed complete, a lump sum; price $.....

(b) Bidder shall quote here a price per receiving set for extra sets, if more than eight are needed of accepted type. Price each $.....

(c) Bidder shall quote here a price for aerial towers installed; price for two $.....

(d) Bidder shall quote here discount for cash for payment made on or before the 10th of the month following receipt and proper operation of the complete equipment which has been installed and accepted; quote here in percentage %.....

(e) Bidder shall state here number of calendar days required to furnish, install above equipment and place it in service. Number of calendar days .....

(f) Bidder agrees to pay to the City of Milwaukee five ($5.00) dollars per day for each and every calendar day's delay in the completion of this contract beyond the time stated in his bid.

(g) Bidder shall furnish with bid, drawings or sketches of above equipment.

Footnote—You may bid on item (c) only if you desire. Check or bond to be in the same amount as specified for bids on all equipment.

Agreeably to the terms of your advertisement inviting proposals for such work, the undersigned hereby agrees to enter into a contract with the City of Milwaukee with satisfactory sureties for the performance of the said work.

The subscriber herewith deposits with the Central Board of Purchases of said City of Milwaukee the sum of .....dollars, in money (or by duly certified bank check payable to the order of said Central Board of Purchases) pursuant to the terms of said advertisement, and hereby agrees that in case the contract for the said work above specified shall be awarded to the subscriber, and the said subscriber shall fail to exe-

cute a contract accompanied by a bond with satisfactory sureties for the performance of the said specified work for the above specified price, within a reasonable time after the said contract for said work is prepared and ready for execution, then such sum of money (or certified bank check) deposited by the subscriber as aforesaid shall become the property of said City of Milwaukee as fixed and liquidated damages for such default, and shall be paid by said Central Board of Purchases to the City Treasurer of said city; provided, however, that in case the contract for the work herein bid for is not awarded to the subscriber, or that in case the said contract shall be awarded to the subscriber and the said subscriber shall execute the said contract, pursuant to this bid, and shall accompany such contract with a good and sufficient bond with satisfactory sureties, then, and in each of such cases, said sum or money (or certified bank check) shall be returned to the subscriber.

Name .....

Address .....

Witnessed by:

Signed per.....

.....

.....

.....

(State official capacity)

Directions to bidders

The Board of Purchases will determine the lowest responsible bidder qualified to perform and complete this contract to the best interests of the City of Milwaukee. If there are tie bids, they will be decided by the Central Board of Purchases.

All bids must be stated in writing and in figures.

The Central Board of Purchases reserves the right to reject any or all bids, and reserves the right to purchase the aerial towers separately.

Each bid is to be accompanied by a bond in the amount as specified below, or in lieu of the bond, the bidder may deposit with his bid cash or an unqualified CERTIFIED check, drawn to the order of the Central Board of Purchases, in the amount as specified below:

Bond of $500.00 or certified check of $250.00.

If bidder fails to submit a bond or check with his bid, as directed, his bid cannot be accepted.

Important: In case bonds are submitted with bids, local bondsmen or a surety company authorized to do business in Wisconsin will be required, said bond to be approved as to form and execution by the Milwaukee City Attorney before being presented with the bid.

Successful bidder agrees to enter into contract on file in the office of the Central Board of Purchases, and to furnish bond in the full amount of the contract.

Specifications for radio equipment

1. These specifications are being sent to you in duplicate, one copy is to be filled out completely and returned with bid, and the other is for your files. The bid is to be placed on sheet No. 1, the first sheet in these specifications. The bid must be signed in order to receive consideration.

2. Because of the special nature of these requirements, the Board of Purchases will determine the lowest responsible bidder qualified to perform and complete this contract to the best interests of the City of Milwaukee.

3. These specifications are intended to provide for the furnishing and installation of one 300 to 400 watt standard make and type radio transmitter and all necessary equipment pertaining thereto fully licensed to City of Milwaukee and required for the proper operation thereof: 8 automobile radio receiving sets of standard make and type fully licensed to City of Milwaukee required for the proper operation thereof; aerial and two steel towers of proper height installed complete on roof of Safety Building, Eighth and State Streets, Milwaukee, Wisconsin; engineering service necessary to instruct city radio operators in the use and maintenance of all equipment furnished; one year's guarantee against all defects in workmanship and material; 90 days maintenance service on all equipment without additional charge, this to include the replacing of tubes and of other parts of equipment requiring repair and maintenance during this period, charging of batteries excepted. Sufficient drawings or sketches shall be furnished with bid showing layout, dimensions and method of installation of (a) transmitter, (b) aerial towers, (c) receivers.

4. *Transmitter.* Transmitter shall be of 300 to 400 watt capacity and must be crystal control and must conform with all rulings of the Federal Radio Commission as to frequency, stability and percentage of modulation. It shall be installed complete on the sixth floor of the Safety Building, located at Eighth and State Streets, Milwaukee, Wisconsin. Antenna for aerial towers, necessary cable, and guy wires to prevent swaying shall be included and installed.

The room in which transmitter equipment is to be installed is nineteen and a half feet long, ten and a half feet wide and eleven feet, eleven inches high. Contractor shall furnish and install cable from transmitter to switchboard of Police Department located on the third floor of the same building. The cable terminal at switchboard end shall be complete with fittings to provide for the microphone physical connection with the switchboard and also remote control push button for starting transmitter, and signal light to show when transmitter is on the air.

The transmitter shall be properly licensed and standard equipment. The contractor shall protect the City from any and all expense arising

from any and all claims of patent infringement which may be made against the City because of the purchase and use of this equipment. The contractor shall pay all fees, costs, royalties, damages and judgments which may be assessed against the City by reason of its purchase and use of this equipment.

5. Each bidder shall furnish here the following information:

A. *Vacuum tube apparatus.*

(a) Make..... Manufacturer's No.....

(b) Type.....

(c) Oscillator:

Type of circuit.....

Number of tubes.....

Plate current (per tube).....

Plate voltage .....

(d) Number of intermediate power amplifier stages, if any .....

.....

(e) Ratings of stages.....

(f) Power amplifier, if used (last stage):

Number of tubes.....

Normal operating: Plate current (per tube)

.....

Plate voltage .....

Manufacturer's rating of tubes:

Plate current .....

Plate voltage .....

Power output.....watts.

(g) Modulator: Make.....

Manufacturer's No. .....

Plate current (per tube).....

Plate voltage .....

Which radio stage is modulated?.....

(h) Maximum power output .....watts.

(i) Plate power supply for transmitter.....

Ratings (voltage and current).....

What is maximum percentage of modulation?.....

.....

(j) Maximum and minimum frequencies to which transmitter can be tuned are.....kc, and.....kc.

B. Normal radiated power.....watts.

Height of antenna (from its ground or counterpoise to highest point of antenna).....meters.

(Bidder to determine this and guarantee to be of proper height).

C. (1) Bidder shall state prices hereon or file price list for extra power tubes and essential repair parts.

(2) Time of delivery of repair parts.....days.

D. Do you guarantee that any and all parts can be furnished by yourself? .....

6. *Antenna towers:*

Two steel aerial towers of proper height shall be installed and anchored properly and securely on roof of Safety Building if permitted by Federal Radio Commission, otherwise bids must be rejected. The main roof of the City part of Safety Building is approximately 106 feet from ground at Eighth Street and 92 feet from ground at Ninth Street. Each bidder shall bid on high quality steel towers which bidder guarantees to be of proper height and bidder shall state in his bid the height of tower he proposes to furnish. These towers to be of proper heavy gauge open hearth class A structural steel properly reinforced and trussed. All structural steel and bolts to be hot dipped with pure zinc. Bolts to be not less than ⅝-inch in diameter. Corner splices to be butt splices with machined bearing. Each tower to be fitted with a hot dipped galvanized steel ladder on one face. Steel truss templates to be supplied and attached for setting anchorage. Top sheave to be not less than eight inches in diameter and to be graphite bronze bushed. Towers to be so constructed as to withstand a wind velocity of 115 miles per hour. The Board of Purchases reserves the right to purchase these towers separately.

Contractor shall furnish the following equipment:

7. *Receiving sets.*

Eight automobile receiving sets complete with tubes, aerials, batteries, as follows:

(1) Four receiving sets to be installed in sedans in possession of Police Department. Contractor shall open tops, remove wire screen and place aerial therein, if aerial in top is used.

(2) Four receiving sets to be installed in new cars furnished by the City. Contractor can arrange to have aerials installed in cars on assembly line. If receiving sets draw more than 1¼ amperes A current, state herein amount of current consumed. .....amperes.

Sixteen 180 ampere hour high quality heavy plate storage A batteries. B batteries to be of heavy duty type. Receiving sets to be contained in heavy gauge metal box attached and locked to back of front seat with heavy brackets, bolts and lock to insure against vibration and theft. Means shall be provided for quick removal of receiving sets for the making of adjustments and repairs. Bidder to state number of tubes he proposes to furnish with each receiving set.

Receiving sets to have locked fixed setting for wavelength of transmitter at Police Headquarters, and to be fitted with volume control and automatic volume control to compensate for interference of steel structures preferred, if advisable.

Receiving sets shall have a range equal to that of the transmitter, and in no case shall the range be less than 2500 kc to 1500 kc. A larger range will be preferable. Bidders shall state herein range to be furnished, from.....kc to .....kc.

State on this sheet whether receiving sets have automatic compensating volume control, or whether volume control is manual, or both

.....

8. The awarding of this contract is contingent upon whether a Federal radio license is granted to the City.

9. *Experience and responsibility of bidder.* Each bidder shall state on this sheet what experience bidder or the firm which he represents has had in the manufacture and installation of radio equipment of this or similar nature. State where this equipment has been installed, name of purchaser, and length of time in service. (If more space is needed, attach typewritten sheets.)

APPENDIX 2

Contracts Covering Regional Police Radio Organization and Service

AGREEMENT

This agreement, made and entered into this 17th day of August, 1931, by and between the City of Berkeley, California, a municipal corporation, hereinafter called the party of the first part, and.....hereinafter called the party of the second part.

WITNESSETH:

Whereas, in the interest of public convenience and necessity it is deemed advisable to unite the territory within the Counties of Alameda and Contra Costa for the purpose of establishing therein a complete police radio communication system; and

Whereas, the party of the first part is willing to construct a central broadcasting station to serve the said counties and all municipalities in said counties, without discrimination, and the said party of the second part is desirous and willing to coöperate and use the said broadcasting station; and

Whereas, the total population of the counties of Alameda and Contra Costa exceeds 500,000.

Now, therefore, for and in consideration of the premises and the mutual promises herein contained, the parties hereto agree as follows, to-wit:

One. The said party of the first part agrees to apply in its own name to the Federal Communications Commission within 60 days from and after the date of this agreement, for a police radio station construction permit to construct a station for the purpose of disseminating information pertaining to the safety of the public in general, to be operated at a power sufficient to adequately cover the said counties of Alameda and Contra Costa; said power and frequency to be determined by field intensity surveys and experimental tests. Said application and permit to be in conformance with Section 101 of the Radio Act of 1927.

Two. The said party of the first part agrees that upon the receipt of a construction permit authorizing it to accomplish all of the objects set forth in Paragraph "ONE," which, in the opinion of the said party of the first part, authorizes it to economically construct a station of sufficient power and proper frequency to fully accomplish the objects contemplated by this agreement from a practical point of view; then, and in that event the said party of the first part will proceed to construct said station in accordance with said permit; provided, however, that

if said station, in the opinion of the party of the first part, cannot be so constructed and operated, this agreement may be cancelled and terminated by resolution of its said Council declaring the said agreement to be cancelled and terminated, and instructing the City Clerk to serve a copy of said resolution by registered mail upon the party of the second part, and the Federal Communications Commission.

Three. The party of the first part agrees that if and when said station is completed, a license to operate will be applied for, and upon receipt of said license, the said party of the first part agrees to regularly operate and maintain said station and furnish service without cost to the said party of the second part; said service to consist of disseminating information, without discrimination, pertaining to the safety of the public in general to be expressly limited to crime emergencies, and in accordance with the rules and regulations to be hereafter adopted with the mutual consent of the parties hereto.

Four. The said party of the second part agrees that it will not, during the term of this agreement, apply to the Federal Communications Commission for either a permit to construct a police radio station or a license to operate such a station, and this agreement will be the authority for the Federal Communications Commission to refuse to issue either said permit or license to the said party of the second part.

Five. Said party of the second part agrees to accept police radio broadcasting service from the said party of the first part during the term of this agreement in accordance with the rules and regulations to be hereafter adopted, without cost to the said party of the second part; provided, however, that any and all receiving apparatus installed by the said party of the second part shall be at its own expense, and the party of the first part agrees to furnish all reasonable advice and information to the party of the second part in choice of receiving equipment, and the party of the second part agrees not to install any receiving equipment which in the opinion of the party of the first part would not readily lend itself to coördination and use with the equipment of the broadcasting station of the party of the first part and the system contemplated by this agreement.

Six. It is mutually understood and agreed that said rules and regulations to be hereafter adopted shall be in all respects practicable and reasonable, and for the best interest of public convenience and necessity and the efficient operation of a police radio broadcasting system.

Seven. It is mutually understood and agreed by the parties hereto that this agreement shall remain in full force and effect, and shall not be subject to cancellation except as provided in Paragraph "TWO" hereof, for a period of 12 months from the date of this agreement, and shall after that time continue in full force and effect until 30 days after either party, by resolution of its legislative body, has declared it to be

its intention to cancel this agreement, and notified the other party in writing to that effect, and after the expiration of said 30-day period this agreement shall automatically terminate and become null and void, and the legislative body of either party is hereby authorized to pass a resolution to that effect. Said resolutions shall be served by or upon the Clerk of the Municipality and/or county, as the case may be, by registered mail, and like copies served upon the City Manager of said Municipality, if there be one, and if not, upon the City Attorney or District Attorney of said Municipality or county, as the case may be.

In witness whereof, the parties hereto have hereunto set their corporate names and seals by their officers thereunto duly authorized, the day and year first hereinabove written.

CITY OF BERKELEY

By.....
(Mayor)

Approved as to form: By.....
(City Clerk)

By.....
(City Attorney)

By.....
(City Attorney)

CITY OF ———

By.....
(Mayor)

By.....
(City Clerk)

Since these agreements may vary somewhat in form and detail, the contract employed by the police of St. Paul, Minnesota, is here quoted also:

STATE OF MINNESOTA }
COUNTY OF RAMSEY } SS.

Thomas A. Brown, being first duly sworn, deposes and says that he is the Chief of Police of the City of St. Paul, in the County of Ramsey and State of Minnesota. That under affiant's supervision, as such Chief of Police, there is now and has been for some time last past maintained and operated in the said city of St. Paul police radio station WPDS, under and pursuant to a license duly issued therefor by the United States Department of Commerce, Radio Division. That by virtue of said license, there has been specifically allotted to said radio station regular operating power of 150 watts for regular transmissions, and for experimental purposes an operating power of 500 watts.

That there is situated in the area contiguous to the City of St. Paul, in Dakota County, Minnesota, two other municipalities, the City of West St. Paul and the City of South St. Paul, neither of which has a

police radio station or a license for the operation of a police radio station. That in reliance upon the existence and operation of said station WPDS, and for the expedition of police work and coöperation therein with the City of St. Paul, said cities of West St. Paul and South St. Paul procured and are now operating radio equipped police motor vehicles, and receiving therein transmissions relative to police work from said station WPDS, and the maintenance and operation of said station is essential to effective police work not only in the city of St. Paul, but as well in said adjacent municipalities.

That the sheriff of Ramsey County, Minnesota, has made extensive plans for the operation of radio equipped police cars in the prosecution of police work in said county but without the limits of said city of St. Paul, dependent upon the operation of said station WPDS and the reception of radio communications therefrom to such cars.

That it will not be practicable to attempt to coöperate in the police work by means of radio of the City of St. Paul, said adjacent muncipalities and said county through said station WPDS except upon an operating power of 500 watts for regular transmission. That it is essential to effective police work by the City of St. Paul that coöperation be had by means of radio transmissions from said station with the police departments of said municipalities and the County of Ramsey.

That upon the granting of a license by the Department of Commerce, Radio Division, allowing said station WPDS an operating power of 500 watts for regular transmissions, said coöperative plan of police work embracing said City of St. Paul, said County of Ramsey and said adjacent municipalities will be placed and kept in complete operation, and to affiant's best knowledge, information and belief, said County of Ramsey and said adjacent municipalities will not find it necessary to request individual facilities for such police radio work, and will accept such coöperative service from station WPDS in lieu thereof.

(.....Signed by.....)

County Authorities *Chief of Police*

The following affidavit of county authorities supported the agreement just quoted:

STATE OF MINNESOTA }
COUNTY OF RAMSEY } ss.

George H. Moeller, being first duly sworn, deposes and says that he is now and has been for several years last past the duly qualified and acting sheriff of the County of Ramsey, State of Minnesota, and as such, among other things, has supervision of police work within said county and without the corporate limits of the City of St. Paul.

That affiant has read the annexed affidavit of Thomas A. Brown, Chief of Police of the City of St. Paul, and that the same is true, that

affiant, as such sheriff, has made extensive plans for the operation of police cars, radio equipped, within said county and without the corporate limits of said city for the reception of radio messages from station WPDS, dependent upon the granting of a license for operating power to 500 watts for regular transmissions by said station WPDS.

That it would be impracticable to attempt the coöperative police service outlined in said accompanying affidavit of Thomas A. Brown by means of radio unless such license allowing such operating power to 500 watts were granted. That upon the granting of such license allowing station WPDS an operating power of 500 watts for regular transmissions, there will be no necessity for a request on the part of the county of Ramsey for individual radio facilities, and it is affiant's belief that said county will accept the services from station WPDS as outlined in said affidavit, and will not request individual radio facilities.

(.....Signed by.....)

Notary Public *County Authorities*

APPENDIX 3

Municipal Legislation on Radio Interference

AN ORDINANCE PROHIBITING ELECTRICAL INTERFERENCE WITH RADIO RECEPTION AND PROVIDING FOR PUNISHMENT FOR VIOLATION THEREOF

Be it ordained by.....

Section 1. That it shall be unlawful for any person, firm, copartnership, association, or corporation, knowingly or wantonly to operate or cause to be operated, any machine, device, apparatus, or instrument of any kind whatsoever within the corporate limits of the city of ..... between the hours of ..... o'clock.....M. and 12 o'clock midnight, the operation of which shall cause reasonably preventable electrical interference with radio reception, within said municipal limits; Provided, however, that X-ray pictures, examinations, or treatments may be made at any time if the machines or apparatus used therefor are properly equipped to avoid all unnecessary or reasonably preventable interference with radio reception and are not negligently operated.

Section. 2. That this ordinance shall not be held or construed to embrace or cover the regulation of any transmitting, broadcasting, or receiving instrument, apparatus, or device used or useful in interstate commerce, or the operation of which instrument, apparatus, or device is licensed or authorized by or under the provisions of any act of the Congress of the United States.

Section 3. That every person, copartnership, association, firm or corporation violating any of the provisions of this ordinance shall, upon conviction, be punished by fine of not less than..... dollars, nor more than..... dollars, or by imprisonment in the city jail for not less than..... days, nor more than..... days, or by both such fine and imprisonment. Each day during which such violation continues shall constitute a separate offense.

Section 4. That this ordinance shall take effect, etc. (here follow requirements of state laws).

Following is a partial list of municipalities and other jurisdictions which have already enacted laws against preventable external interference with radio reception.

Brattleboro, Vt.	Two Harbors, Mich.	Hagerstown, Md.
Grand Rapids, Mich.	Chesangin, Mich.	Cole Camp, Mo.
Sault Ste. Marie, Mich.	Beverly, Mass.	Sedalia, Mo.
Bay City, Mich.	State of Maine	Boonville, N. Y.

Millville, N. Y.	Wausau, Wis.	Alhambra, Calif.
Miles City, Mont.	Los Angeles, Calif.	Riverside, Calif.
Portland, Ore.	Inglewood, Calif.	San Diego, Calif.
St. Paul, Minn.	Pasadena, Calif.	Valentine, Nebr.
Dumbright, Okla.	South Pasadena, Calif.	Mt. Pleasant, Mich.
Clinton, Ia.	Santa Ana, Calif.	Marinette, Wis.
Fairfield, Ia.	Stockton, Calif.	

As a further illustration of the form taken by this type of regulation, there is given below an ordinance now in effect in Los Angeles, Calif.

Be it ordained by the City Council of the City of Los Angeles, California—

An ordinance regulating the use of devices or apparatus which interfere with radio broadcasting reception.

The People of the City of Los Angeles, California, do ordain as follows:

Section 1. It shall be unlawful for any person, firm or corporation to operate in the City of Los Angeles any apparatus generating or causing high frequency oscillations which interfere with radio broadcast receiving apparatus or wireless receiving apparatus between the hours of 6 o'clock P.M., and 11 o'clock P.M., except that a person duly licensed to practice medicine, osteopathy, chiropractic or dentistry by the State of California, in a case of absolute emergency arising in the course of practice of his profession and which case demands immediate treatment between the afore-mentioned hours, may operate or cause to be operated under his direct supervision any machine necessary to give emergency treatment in such case.

Section 2. Any device or apparatus such as violet ray machines, machines using the Tesla Coil or principle, X-ray machines and Diathermy machines which interfere with the intelligibility of reception under all the following conditions shall be considered as coming within the terms of this ordinance:

(a) Such device or apparatus must be situated one hundred (100) feet or more from the radio receiving equipment with which it interferes.

(b) The radio receiving equipment interfered with shall be operated at a volume comparable to a person speaking in a normal tone of voice.

(c) The broadcasting station whose program is being received when the interference occurs must have a power output of at least one (1) kilowatt and must be located not more than twenty-five (25) miles distant from the receiving set.

It is expressly understood and provided, however, that this ordinance shall not apply to radio stations either broadcast, commercial

or amateur, licensed by the Federal Government and/or which are engaged in interstate communication or to public utilities under the supervision of the State Railway Commission.

Section 3. The Chief of the Electrical Division of the Department of Building and Safety, or his duly authorized Deputies, shall have the right to enter upon any premises at all reasonable hours for the purpose of inspecting the installation and working of all apparatus coming within the terms of this ordinance, and it shall be unlawful for any person, firm or corporation to interfere with the Chief of the Electrical Division of the Department of Building and Safety or his duly authorized Deputies, in making said inspection or to refuse to permit the said Chief or his Deputies to enter the premises for such purposes.

Section 4. When an inspection and test shall have been made by the Chief of the Electrical Division of the Department of Building and Safety or his duly authorized Deputies and it is found that equipment or apparatus coming within the terms of this ordinance is being operated in violation of this ordinance the person or persons responsible for the operation of such equipment shall be notified in writing to discontinue the use of such machine or to make additions, repairs or modifications thereof in order that the same may be operated in a manner which complies with the provisions of this ordinance. The mailing of a registered letter addressed to the owner or operator of the machine at the premises where the machine is located shall constitute a sufficient notice for the purpose of this ordinance. In the event that the owner or operator of such machine or apparatus does not, within forty-eight (48) hours after receipt of notice to repair or discontinue the use of such machine, either entirely discontinue the use of such machine during the hours the use of such machine is prohibited by this ordinance, or repair the same so that it complies with the provisions of this ordinance, such owner shall be deemed to be operating such machine or apparatus in violation of the provisions of this ordinance, and such persons shall be subject to the penalties hereafter provided for such violation.

Section 5. Any person violating any of the provisions of this ordinance shall be deemed guilty of a misdemeanor and upon conviction thereof shall be punishable by a fine of not more than five hundred ($500.00) dollars or by imprisonment in the city jail for a period of not more than six (6) months, or by both such fine and imprisonment.

APPENDIX 4

Municipal Radio Legislation

Oklahoma City, Oklahoma

AN ORDINANCE PROHIBITING THE FOLLOWING UP AND ANSWERING OF POLICE RADIO CALLS; PROVIDING A PENALTY FOR THE VIOLATION HEREOF, AND DECLARING AN EMERGENCY.

Section 1. It shall be unlawful and an offense for the operator of any motor vehicle, which is self-propelled, other than police officers, to follow up and answer radio police calls, or to in any way interfere with police officers answering such radio police calls.

Section 2. Any person, firm, or corporation violating any of the provisions of this ordinance shall be deemed guilty of an offense and upon conviction thereof shall be fined in any sum not exceeding ..... and costs.

St. Paul, Minnesota

AN ORDINANCE PROHIBITING THE INSTALLATION OR USE OF ANY SHORT WAVE LENGTH RADIO RECEIVING SET IN ANY TAXICAB, AUTO CAR OPERATED BY PRIVATE LIVERY, OMNIBUS OR PRIVATE AUTOMOBILE OPERATED UPON THE STREETS OF THE CITY OF ST. PAUL BY ANY PERSON NOT HAVING A PERMIT FROM THE CHIEF OF POLICE OF SAID CITY SO TO DO AND FIXING THE PENALTY FOR VIOLATION OF SAID ORDINANCE.

Section 1. No owner or operator of any taxicab, auto car operated by private livery, omnibus, or any other motor vehicle operated upon the streets of the City of St. Paul, for hire, shall equip the same with or install or use therein any short wave length radio receiving set unless such owner shall first secure a permit to do so from the Chief of Police of the City of St. Paul, upon such application as such Chief of Police shall prescribe.

Section 2. No owner or operator of any private motor vehicle used for any purpose upon the streets of the city of St. Paul shall equip the same with or install or use therein any short wave length radio receiving set, unless such owner shall first secure a permit so to do from the Chief of Police of the City of St. Paul, upon such application as such Chief of Police shall prescribe.

Section 3. The term "short wave length radio receiving set," as used herein shall be construed to mean any radio receiving set capable of reception on frequencies from eighty-five meters to and including one hundred and seventy-five meters.

Section 4. Any person violating any of the provisions of this ordinance shall be guilty of a misdemeanor, and upon conviction thereof,

shall be punished by a fine not exceeding $100.00, or by imprisonment for not exceeding 90 days.

Cincinnati, Ohio

It shall be unlawful to equip with a short wave length radio receiving set, any motor vehicle not in the service of a city, county, state or federal department engaged in the apprehension of criminals, or to maintain or operate in the city of Cincinnati any such equipment on any motor vehicle not in such police service, except with the permission of the City Manager and subject to such conditions as shall be imposed by him.

For the purpose of this section, the term "short wave length" shall include any wave length of less than two hundred meters. Any violation of this section shall be punishable by a fine of not to exceed $500.00 or by imprisonment for not to exceed six months or both, and each day's maintenance of the prohibited equipment shall be considered a separate offense.

Rochester, New York

AUTOMOBILES EQUIPPED WITH SHORT WAVE LENGTH RADIO RECEIVING SETS.

A person not a peace officer must not equip an automobile with a short wave length radio receiving set, nor drive or use an automobile equipped with a short wave length radio receiving set within the city of Rochester without having first secured a permit in writing from the Commissioner of Public Safety to do so.

Los Angeles, California

AN ORDINANCE REGULATING THE OPERATION OF MOTOR VEHICLES IN THE CITY OF LOS ANGELES WITH SHORT WAVE LENGTH RECEIVING SETS.

Section 1. Definition. A short wave length radio receiving set shall be any radio receiving set capable of receiving any radio broadcast or message on any frequency above 1500 kilocycles.

Section 2. It shall be unlawful for any person to equip or operate inside of the city of Los Angeles any motor vehicle with a short wave length radio receiving set, unless such motor vehicle is used by a peace officer, or is used by the State or County Government.

No department of the city government shall be authorized to equip or operate an automobile with a short wave length radio receiving set except the police department of the city of Los Angeles, and the police department shall only be authorized to equip cars with short wave length radio receiving sets when such cars are used in the performance of police or fire prevention work or emergency cars under the jurisdiction of the Board of Public Works.

Section 3. The Chief of Police of the city of Los Angeles may issue permits to any person to equip and operate, inside of the city of Los Angeles, a motor vehicle with a short wave length radio receiving set, in the event that such short wave length radio receiving set is used by such person for experimental purposes only.

The Chief of Police may issue permits to equip with a short wave length radio receiving set motor vehicles which are in the service of the Fire Department, or under the jurisdiction of the Board of Public Works, when the Chief of Police in his discretion believes that such cars are doing emergency work in the city and should be so equipped, provided the Chief Engineer of the Fire Department or the Board of Public Works have first requested the Chief of Police to so equip cars which are under their jurisdiction.

Any person desiring a permit from the Chief of Police to operate a short wave length radio receiving set on a motor vehicle inside of the city of Los Angeles, must make application to the Chief of Police in writing for such permit, stating the name of the applicant, the license number and the engine number of the motor vehicle which it is desired to equip with a short wave length radio receiving set and also state the reason why such a permit is desired.

It shall be unlawful for any person who has received a permit from the Chief of Police to equip or operate a motor vehicle with a short wave length radio receiving set, to place such short wave length radio receiving set in any vehicle other than the vehicle mentioned in his application to the Chief of Police, and such person must within thirty days after a change in the license number of such vehicle, notify the Chief of Police of any new license number issued upon any vehicle which is permitted to be equipped with a short wave length radio receiving set.

Section 4. It shall be unlawful for any person to wilfully make to the Police Department of the city of Los Angeles any false, misleading or unfounded report for the purpose of interfering with the operation of the police department, or with the intention of misleading any police officer of the city of Los Angeles.

Section 5. Any person violating any of the provisions of this ordinance shall be deemed guilty of a misdemeanor and upon conviction thereof, shall be punishable by a fine of not more than five hundred dollars or by imprisonment in the city jail for a period of not more than six months, or by both such fine and imprisonment.

Supplementing the foregoing Los Angeles ordinance, it is well to quote from a letter addressed to R. E. Steckel, Chief of Police, Los Angeles, Calif., from the office of the United States Attorney (Samuel W. McNabb), which contains a significant opinion.

"Within the last few months your inspector, F. T. Hawtrey, has

taken up with this office the matter of curbing the practices of ambulance chasing organizations and tow car garages, as the result of which it appears that these organizations have made private use of emergency police information broadcast over radio station KGPL, to the end that their representatives have generally arrived at the scene of the accident either before or at the same time that the police arrived. This, of course, has greatly hindered and impeded the effective work of the police.

"As a result of Inspector Hawtrey's conferences with this office, Mr. Harry Graham Balter, Assistant United States Attorney, took the matter up with the Federal Radio [Communications] Commission and its general counsel at Washington, and this office is now prepared to advise you that after some study and reflection, it is our opinion that wherever an ambulance chasing organization or a tow car garage, or any other individual or corporation uses this private and confidential police information broadcast over radio station KGPL, which is licensed by the Federal Government solely for the purpose of broadcasting dispatches of an emergency nature to squad cars or other mobile units, for their own use and benefit, they are subject to prosecution for violation of Section 27 of the Radio Act of 1927.

"Section 33 of the Radio Act of 1927 provides—'that any person, firm, company or corporation who shall violate any provisions of this act—upon conviction thereof in any court of competent jurisdiction, shall be punished by a fine of not more than $5,000 or by imprisonment for a term of not more than five years or both, for each and every offense.'

"You are advised that if after due notice is given to the general public of the provisions of this act, you find any ambulance chasing organization or tow car garage making use of the information broadcast over station KGPL for their own private benefit, such infractions of the Radio Act of 1927 should be referred to the proper federal authorities, who will vigorously investigate the infractions with a view to criminal prosecution."

Omaha, Nebraska

AN ORDINANCE PROHIBITING THE INSTALLATION AND USE OF SHORT WAVE LENGTH RADIO RECEIVING SETS IN MOTOR VEHICLES OPERATED UPON THE PUBLIC STREETS OF THE CITY; PROVIDING A PENALTY FOR THE VIOLATION THEREOF.

Section 1. No person, firm or corporation shall install or use any short wave length radio receiving sets in any motor vehicle operated or used upon the public streets of the city; PROVIDED, this ordinance shall not be construed to apply to vehicles operated or used by the police department of the city of Omaha, or to vehicles operated or

used by an law enforcing agency of the State of Nebraska or any political subdivision thereof.

Section 2. The term "short wave length radio receiving set" as used herein shall be construed to mean any radio receiving set capable of reception on a frequency between 1500 kilocycles and including 3000 kilocycles, or between 100 meters and including 200 meters.

Section 3. Any person, firm or corporation violating any of the provisions of this ordinance, shall upon conviction be fined not more than one hundred dollars.

APPENDIX 5

Radio Legislation Enacted by States

The Michigan State Law

The prohibitive sections of the Michigan state law are embodied in the following Act.

Act 152, Public Acts 1929. An act to provide for a state owned and operated radio broadcasting station for police purposes only, and to provide for radio receiving sets to be used in connection therewith; to provide for the purchase of materials and the construction of the necessary apparatus, or the purchase of the required equipment; to require priority of service from telephone and telegraph companies for the purposes of this act; to define the powers and duties of the commissioner of the department of public safety hereunder; to permit cities to purchase radio receiving sets from the state; to define violations of this act and to prescribe penalties therefore; and to make appropriations for the purposes hereof.

The People of the State of Michigan enact:

Section 1. The state administrative board is hereby authorized and empowered to purchase the necessary apparatus and equipment, and to construct or establish one or more radio broadcasting stations, one of which shall be erected or established at East Lansing, Michigan; such radio broadcasting station or stations shall be used for police purposes only.

Said board is further authorized and empowered to purchase materials for the construction of radio receiving sets and to direct and require the construction of such sets in some state-owned institution to be designated by such board; Provided, however, that if the purchase of material and the construction of such sets as herein permitted, shall, for any reason, be inadvisable, impractical or undesirable, said board may authorize the purchase of completed sets.

Section 2. The commissioner of the department of public safety is hereby charged with the operation, maintenance and conduct of the said radio broadcasting station or stations and shall furnish to each sheriff in this state without cost, upon his application and the approval of the state administrative board, a radio receiving set, which shall be maintained at the expense of the county, said sets to remain the property of the state. Cities shall be entitled to purchase from the state, radio receiving sets for police purposes at cost.

Section 3. It shall be the duty of the commissioner of the department of public safety to broadcast all police dispatches and reports submitted, which in his opinion shall have a reasonable relation to or

connection with the apprehension of criminals, the prevention of crime, or the maintenance of peace and order in this state, it being the intention of this act to aid and assist peace officers in the discharge of their duties.

Every sheriff and city securing a radio receiving set under the provisions hereof, shall make a report to the commissioner of the department of public safety at such times and containing such information as said commissioner shall require.

Section 4. Every telegraph and telephone company operating in this state shall give priority to all messages or calls directed to the state radio broadcasting station or stations established hereunder, and failure so to do is hereby declared a misdemeanor, and the person responsible for such failure shall, upon conviction thereof, be punished by a fine of not more than one hundred dollars or by imprisonment for not more than ninety days, or both, in the discretion of the court.

Section 5. No person shall equip an automobile with a short wave length radio receiving set, or use same in this state unless such automobile is used or owned by a peace officer, without first securing a permit so to do from the commissioner of the department of public safety upon such application as he may prescribe. Any person violating the provisions of this section shall be deemed guilty of a misdemeanor and upon conviction thereof, shall be punished by a fine of not more than one thousand dollars, or by imprisonment for not more than six months, or both, in the discretion of the court.

Section 6. Any person who shall wilfully make to a state radio broadcasting station any false, misleading or unfounded report, for the purpose of interfering with the operation thereof, or with the intention of misleading any peace officer or officers of this state, shall be guilty of a misdemeanor, and upon conviction thereof, shall be punished as provided in section five of this act.

Section 7. The commissioner of the department of public safety is hereby authorized and empowered to purchase or secure such radio receiving sets as he may deem necessary or desirable for use in the department of public safety, and may employ such radio operators, assistants, or radio maintenance men, as may be necessary to carry out the purposes of this act, subject to the approval of the state administrative board, and the cost of the maintenance and operation of the radio broadcasting station or stations and radio receiving sets owned and operated by the state, as herein provided, shall be paid out of the general appropriation for the said department of public safety.

Section 8. There is hereby appropriated from the general fund for the biennial period ending June 30, 1930, the sum of twenty-five thousand dollars for the purposes and in the specific amounts as follows:

Radio broadcasting station apparatus and equipment	$15,000.00
Radio receiving sets	10,000.00
Total	$25,000.00

Each of the above-named said amounts shall be used solely for the purposes herein stated, subject to the general supervisory control of the state administrative board.

Section 9. The provisions of this act are severable and if any section, sentence, clause or phrase thereof, is for any reason, held to be unconstitutional or invalid, the decision of the court shall not affect the validity of the remaining portions of this act.

The Illinois State Law

House Bill No. 507, 1931—

Section 1. The Department of Public Works and Buildings is authorized to purchase, lease or otherwise acquire and operate one or more radio broadcasting stations in the state to be used for police purposes only. Such radio stations shall broadcast all police dispatches and reports submitted to them which pertain to the apprehension of criminals, the prevention of crime and the maintenance of law and order in order to assist peace officers more effectively to discharge their duties.

Section 2. The Department of Public Works and Buildings, the county board of any county, the city council of any city and the board of trustees of any village or incorporated town are authorized to purchase or acquire and furnish receiving sets to all peace officers under their jurisdiction. These radio receiving sets shall only be used by such officers in the performance of their duties as police officers in this state, and shall always be set and in readiness to receive any report or message that may be broadcasted from any radio broadcasting station operated by the Department of Public Works and Buildings under this act.

Every peace officer receiving a radio set shall make a report to the Department of Public Works and Buildings at such times and containing such information as the Department may require.

Section 3. Every telegraph and telephone company operating in the state shall give priority to all messages or calls directed to the broadcasting station established under this act.

Section 4. No person, except peace officers in this state, shall equip any automobile with a short wave length radio receiving set or use the same in such automobile without first obtaining permission to do so from the Sheriff of the County, from which such automobile is

registered, as shown by the records of the Secretary of State, or in the case of a non-resident, from the Department of Public Works and Buildings.

Before granting such permission, the sheriff or the department shall require a sworn written statement, that such radio receiving set will not be used to assist in the escape of any criminal or for any other unlawful purpose, from the person to whom he grants such permission.

Section 5. Any telegraph or telephone operator who fails to give priority to messages or calls as provided in section 3 of this act, or any person who installs or uses a short wave length radio receiving set in any automobile contrary to the provisions in section 4 of this act, or who wilfully makes any false, misleading or unfounded report to any broadcasting station established under this act for the purpose of interfering with the operation thereof, or with the intention of misleading any officer of this state shall be deemed guilty of a misdemeanor and upon conviction thereof, shall be punished by a fine not exceeding one thousand dollars, or by imprisonment in the county jail not exceeding six months or both such fine and imprisonment.

The New York State Law

The following act was introduced in the New York State Legislature at the 1931 session, passing both houses, but was vetoed by Governor Roosevelt:

Section 1. Article one hundred and seventy-two of the penal law is hereby amended by adding thereto a new section, to be section nineteen hundred and sixteen, to read as follows: §1916—Equipping automobiles with short wave length radio receiving sets.

A person, not a peace officer, who equips an automobile with a short wave length radio receiving set or uses an automobile so equipped, without having first secured a permit so to do from the person authorized to issue such permit by the local governing body or board of the city, town or village in which such person resides, is guilty of a misdemeanor, punishable by a fine not exceeding one thousand dollars, or imprisonment not exceeding six months, or both.

The California State Law

The following proposed act was introduced before the 1933 session of the California state legislature:

An act to provide for the regulation and licensing of short wave length radio receiving sets and the regulation of information rendered to police or other official radio broadcasting stations, to pre-

scribe the duties of the California Highway Patrol in relation thereto, and to provide penalties for the violations thereof.

Section 1. (*Definitions.*) (a) "Short wave length radio receiving set" means any receiving set capable of receiving any radio broadcast or message on any frequency above 1500 kilocycles.

(b) "Vehicle" means any device as so defined in the California Vehicle Act.

(c) "Official" means a member of a regularly organized fire department, or a state, county or city officer.

(d) "Person" means any individual, corporation, copartnership, association or other organization.

Section 2. It shall be unlawful for any person other than a peace officer or official to maintain, operate, or otherwise use any short wave length radio receiving set in any vehicle owned by him or in his possession and control without first securing a permit issued under the provisions of this act to do so.

Section 3. It shall be unlawful for any person to install, repair, or offer to install or repair, a short wave length radio receiving set in any vehicle unless such vehicle is exclusively owned, operated, or maintained by a peace officer or official, or by a person who has a secured permit duly issued under the provisions of this act and who first presents such permit to the person installing, repairing, or offering to install or repair any such short wave length radio receiving set.

Section 4. It shall be unlawful for any person who has received a permit issued under this act to transfer, place, or otherwise install the short wave length radio receiving set in any vehicle other than the vehicle in respect to which the permit was issued.

Section 5. It shall be unlawful for any person who has received a permit under this act to sell, lease, or otherwise permanently transfer the vehicle in respect to which the permit was issued without first notifying the California Highway Patrol of such intended sale, lease or permanent transfer, and first surrendering the permit to the California Highway Patrol with such information concerning the sale, lease, or permanent transfer as may be required.

It shall also be unlawful for any person who has received a permit under this act to sell, lease, or otherwise permanently transfer the vehicle in respect to which the permit was issued without first removing the short wave length radio receiving set therefrom.

Section 6. It shall be unlawful for any person to wilfully make to any police officer or other official radio broadcasting station any false, misleading, or unfounded report for the purpose of interfering with the operation thereof, or with the intention of misleading any peace officer of this state.

Section 7. The California Highway Patrol of the Department of Motor Vehicles or any body succeeding to the powers and duties of such highway patrol, may issue permits to install short wave length radio receiving sets in vehicles to persons engaged in scientific research in the field of radio, and to such other persons who prove to the satisfaction of the Highway Patrol that said radio set will be used for a lawful purpose and is essential to the conduct of the applicant's business.

Every application for a permit under the provisions of this act shall contain in such form as the California Highway Patrol may prescribe:

(a) The name, address, business or occupation of the applicant.

(b) The purpose for which the short wave length radio receiving set is desired.

(c) The registration and engine number of the vehicle in respect to which the permit is to be issued; and

(d) Such other information as the Highway Patrol may require.

The California Highway Patrol shall make such rules and regulations relative to the application for and issuance of permits as are necessary to fully carry out the provisions of this act, and shall designate convenient places throughout the state where application blanks and permits may be obtained.

All permits issued under this act are immediately forfeited upon the sale, lease, or other permanent transfer of the vehicle in respect to which the permit was issued, or upon the transfer, placing, or installing of a short wave length receiving set in any vehicle other than the one in respect to which the permit was issued.

Permits may be issued for such time as the California Highway Patrol deems necessary under the circumstances of the case. The continuance of such permit may be conditioned upon any fact necessary for the enforcement of this act. If at any time the holder of any permit violates any provisions of this act, such permit may be revoked without notice or without benefit of a hearing on such revocation.

The California Highway Patrol shall charge for the issuance of permits such fees as are necessary to defray the expense of administering the provisions of this act. All such fees shall be paid into the Motor Vehicle fund, and shall be used in such manner and for the same purposes as other moneys in said fund.

Section 8. Any person who violates any of the provisions of this act shall be guilty of a misdemeanor and on conviction thereof shall be punished by imprisonment in the county jail for not more than six months, or by a fine of not more than one thousand dollars, or by both such fine and imprisonment.

APPENDIX 6

The New York State Teletype System—Operating and Record Procedure

As an introduction to the manual of operating and record procedure of the New York State Teletype System, the following terms and their definitions are given.

Teletypewriter service.—A communication service involving transmission of typewritten messages by means of teletypewriter instruments and connecting wires so arranged that the operation of one machine simultaneously operates all other machines on the circuit or circuits associated with the sending machine.

Police teletypewriter system of the State of New York.—The police communication system of teletypewriters as established within the Division of State Police by authority of Chapter 633 of the Laws of 1931.

Associated system.—The police teletypewriter system of any city, county, town or village of this state or such a system in any other state, connected with the police teletype system of the State of New York.

Telegraph bureau.—That part of the headquarters of the Division of State Police in the Capitol at Albany wherein is located the control point for District H of the police teletype system, the radio broadcasting room, and from which point is exercised the supervision of the entire police teletype system of the State of New York.

Supervisor, Telegraph Bureau.—The officer assigned by the Superintendent of State Police to be in charge of and control of the police teletype system and police radio broadcasting.

Chief system operator.—The operator at the telegraph bureau, so assigned by the Supervisor, Telegraph Bureau.

Control point.—That part of the barracks of Troops A, B, C, D, K, containing the control board or switchboard, teletype instruments and other system equipment, at which is received all teletype messages sent over circuits terminating in such switchboard, and from which all messages so received are given distribution.

Control points are designated by the following letters:

Barracks, Troop A, Batavia	A
Barracks, Troop B, Malone	B
Barracks, Troop C, Sidney	C
Barracks, Troop D, Oneida	D
Barracks, Troop K, Hawthorne	K
Telegraph Bureau, Albany	H

Control point operator.—The operator receiving and dispatching teletype messages at any control point.

Control point connecting circuit.—The circuit directly connecting one control point to another control point.

District.—That portion of the system controlled from a control point.

District circuit.—A circuit terminating in a switchboard to which SP or PD teletypewriters are connected. There may be one or more teletypewriters connected to any district circuit.

District sending and receiving station.—PD or SP point at which is a teletypewriter from which messages can be both sent and received. Such a station is always abbreviated as "SR."

District receiving only station.—PD or SP point at which is a teletypewriter equipped only for receiving messages. Such a station is abbreviated as "R."

PD.—Police department (municipal).

SP.—State Police.

Message.—A teletype communication sent in the form prescribed by the "message form" section herein.

Message number.—The numerals in the upper left-hand corner of a message which indicate the numerical consecutiveness of the message.

File classification number.—The number following the word "File" in the message, in accordance with the file number classification chart, which number establishes the file under which the message is to be carried. It also gives advance information as to the contents of the message which is about to be received.

Added information message.—A message dispatched for the purpose of adding to an original message some information deemed necessary for further explaining the contents of such message or giving additional facts concerning the matter included in such message. AN ADDED INFORMATION MESSAGE ALWAYS TAKES THE SAME MESSAGE NUMBER AND FILE CLASSIFICATION NUMBER AS THE ORIGINAL MESSAGE, AND THE WORDS "ADDED INFO" are included thereon as explained by the "message form" referred to above.

Correction message.—A message dispatched for the purpose of correcting any part of some message previously sent. A CORRECTION MESSAGE ALWAYS TAKES THE SAME MESSAGE NUMBER AND FILE CLASSIFICATION NUMBER AS THE ORIGINAL MESSAGE WHICH IT CORRECTS. The word "CORRECT" is always included on this type of message.

Cancellation message.—A message dispatched which cancels some message previously sent, and indicating that the purpose of the original message has been fulfilled in whole or in part. A CANCELLATION MESSAGE IS GIVEN A NEW MESSAGE NUMBER BUT CARRIES THE SAME FILE CLASSIFICATION NUMBER AS THE ORIGINAL MESSAGE WHICH IT CANCELS. The word "CANCEL" is included immediately following the date of cancella-

tion. The body of the cancellation shows the date of the original message which it cancels and such other data, in special cases, as may be necessary

Reply message.—A message which contains information replying to some message previously sent over the system. The word "REPLY" appears on such communications immediately following the date of the message. In the body of the reply message there must be a reference to the message number, file classification number and date of the message to which the reply is made.

Message direction.—The point or points to which a message is directed.

General alarm.—A message direction indicating that the message is to be sent to all points on this system and all associated systems. A "General Alarm" is always directed to GA.

Point to point message. Designates messages from a point on the New York or any associated system directed specifically to any other point of this or any other associated system.

Selected group message.—A message from any point on any system directed to a specified group of district stations or control points, as indicated by the "message direction."

Broadcast.—The sending of a message by a control point on all of its circuits (except the circuit from which the message was received) by one typing operation through use of the "broadcast jack" on the switchboard. A general broadcast is identified by the fact that it is directed to "GA."

Selected broadcast.—The sending of a message by a control point on two or more circuits radiating from the control board, by one typing operation through the use of the "broadcast jack" on the switchboard. It is to be noted that if all circuits are used, *except the one from which the message was received,* it is a "broadcast," but if some one circuit, *in addition to the receiving circuit,* is not used, it is then designated as a "selected broadcast."

"Selected broadcasts" may be identified by their particular message direction; some are directed to two or more specific points, while others are directed to two or more circuits. The message direction is carefully noted in order to determine whether the operation is a "broadcast" or a "selected broadcast."

Authority.—This word abbreviated as "AUTH" indicates that the name following the abbreviation is responsible for the sending of the message.

Signature.—The name of the person who actually operated the original message. The signature is always repeated throughout the entire system.

Message time.—The time, appearing immediately after the signature, which indicates the hour and minute when the original sending of the

message was actually completed. The message time is always repeated throughout the entire system.

Repeated message.—A message received at a control point from a district station or from some other control point which must be repeated by the receiving operator to any district station, group of district stations or other control point or points, or both.

Domestic repeated message.—A message received by a control point from some district station terminating in that control board, and which must be repeated by the receiving operator to any district station, group of district stations or other control point or points, or both.

Foreign repeated message.—In this instance the message received at a control board, which originated at some district station NOT TERMINATING IN THE RECEIVING CONTROL BOARD, and which must be repeated by the receiving operator to any one or any group of his district stations, or to any one or more control points. However, a message which originates within some given control point district and which, when received at some other control point, must be repeated by the receiving operator to any one or to any group of his district stations, or to any control point or control points, or both, is considered as a FOREIGN REPEATED MESSAGE.

Acknowledgment.—That particular operation by a control point operator, performed by him upon receipt of a message at his control board, which indicates to the sending operator that the message has been transmitted fully and is legible.

Junk.—A term used indicating that a message just received, has been jumbled up, by reason of mechanical difficulties, etc., so as not to be legible.

Line feed key.—The key on an SR teletypewriter which shifts the paper upward. It is used after completing a line to permit typing on the next line below, so that one line will not be typed over another.

Carriage return key.—The key on an SR teletypewriter which returns the carriage to the beginning of a line. When a carriage return key is used, it should always be struck twice.

Space bar.—The long black bar at the front of the keyboard, as in the standard typewriter, which permits spacing between words, letters, figures, etc. The space bar on a teletypewriter, if held down, will cause the instrument to make continuous spaces.

Letters key.—The key which must be depressed in order to permit the writing of letters as indicated by the keyboard.

Figures key.—The key which must be depressed to place the carriage in position so that the upper case characters of the keyboard may be typed. It is necessary to strike the FIGURES KEY before writing figures or upper case characters.

Bell signal.—This is for the purpose of attracting attention to the message, or when used between control points, for the purpose of re-

questing a control point acknowledgment. The upper case "S" key is employed for this purpose.

Alarm bell signal.—The bell connected with all SR and R teletypewriters at State Police points, for the purpose of calling attention to the fact that the instrument is about to type a message. The alarm bell signal may be disconnected by use of the switch supplied with same, when there is someone in attendance at the instrument. It is always turned on when the men assigned to a substation have retired for the night.

Authorized abbreviations.—For the purpose of brevity and speed in teletypewriter message traffic, words and terms frequently used may be abbreviated. The following list of authorized abbreviations is typical:

SP	State Police
PD	Municipal Police Department
PDNY	Police Department, City of New York
TBPDNY	Telegraph Bureau, Police Department, City of New York
OK	Message received completely. All right
OKGA	All right, go ahead and send message
LT	Circuit trouble
MT	Machine trouble
BZ	Busy circuit or circuits
DL	Delayed. DLLT means repeating of message delayed account of circuit trouble; DLBA, account busy circuits; DLMT, account machine trouble.
RP	Message repeated by
TBL	Trouble
AUTH	Message sent on authority of....
MESA	Referring to your message
REF	Please refer to our message
VOID	Cancel our message
MIN	Stay on the line and I will answer you very shortly
GA	General Alarm
DATA	We request owner's name, address, make of car, motor number etc., covered by the following license number plates
CODE SIG	Code Signal
ATT	Attention of
CP	Chief of Police
INSP	Inspector
CAPT	Captain
LIEUT	Lieutenant
DET	Detective
SERGT	Sergeant
CORP	Corporal
TRP	Trooper
DEP	Deputy
SUPT	Superintendent
OPR	Operator
AM	Forenoon
PM	Afternoon
MOT	Motor number
SER	Serial number
LIC	License number

Transmitting descriptions of persons.—57–5–9–160 indicates the method of including descriptions of persons in teletypewriter alarms in the New York system. First appears the age (57), next the height in feet (5), inches (9), and finally the weight (160).

Where the exact age, height or weight are not accurately known, the description follows the same sequence, but includes the limits between which such is estimated, as: 57–60–5–8–9–160–170. This indicates that the person is between the ages of 57 and 60; between the heights of 5 feet 8 or 9 inches, and between the weights of 160 and 170 pounds. A description of a person is always presumed to be of a white person unless specified to the contrary. It is therefore unnecessary to use the word "white" in a message.

The sex of the person described is usually indicated by the first name, except where first name might be applicable to either male or female, in which event the sex is specified in the message.

Message forms—

Form No. 1—The Original Message

"467 FILE 8 SP BATAVIA JAN. 10–32
TO GA
WANTED FOR THE HOLDUP OF A GASOLINE STATION JUST WEST OF THIS CITY AT ABOUT 8 PM THIS DATE; TWO MEN TRAVELING IN AN OLD MODEL TOURING CAR, MAKE AND LICENSE UNKNOWN:
NO. 1 35–40–5–6–8–150–175 BROWN SOFT HAT GRAY OVERCOAT
NO. 2 16–18–5–9–10–135 NO HAT BROWN SHEEPLINED OVERCOAT MAN HAS A VERY LARGE SCAR EXTENDING ENTIRE LENGTH OF LEFT CHEEK.
AUTH SERGT. RIMMER MC DONALD 8–15 PM"

The message is analyzed as follows: 467 indicates that it is the 467th consecutive message originated by the sending station. Message numbers begin with number one (1) at midnight January first and continue in consecutive order until midnight of the following December thirty-first. Each sending teletypewriter point keeps a sheet of consecutive numbers, and as a number is used, it is crossed off the list. An automatic message counter may be used instead of the list, if desired. Great care must be exercised not to use the same message number twice, since such procedure would completely upset the master files at Control Points. With "Added Information" and "Correction" messages, the same message number may be used, as previously explained.

"FILE 8" classifies the type of message in accordance with the file number and classification chart. Before sending a message, this chart is consulted in order that the message, and all subsequent messages pertaining thereto, will be properly classified. The original file number is always

the controlling message number. All messages sent in connection with the original message, or in reply thereto, carry the original file number. "Reply," "Correction," and "Added Information" messages always refer to the original message number, file classification number, and date of such original, in order to facilitate the location of records already filed. The original numbers are the filing key. When other messages pertaining to the same case are received, they are attached to the back of the original message in the order of their receipt.

"SP BATAVIA" means that the message was originated by the State Police at Batavia. The date of the message follows the point of origin.

"TO GA" indicates the message direction and requests that the message be sent as a "GENERAL ALARM." All control point operators must send a message as directed to all circuits radiating from the point which received it, unless the operator has added some information to it. The body of the message is self-explanatory.

The authority and signature line ends the message.

Form No. 2—Added Information Message

"467 FILE 8 SP BATAVIA JAN. 10–32 ADDED INFO. 1
TO GA
CAR INVOLVED WAS A BUICK TOURING CAR WITH NEW JERSEY PLATES. IT LEFT HERE ON ROUTE 5
TOWARD BUFFALO.
AUTH SERGT. RIMMER MC DONALD 9 PM"

This message takes the same message number and file classification number as the original message (Form No. 1) to which it adds information. The words "ADDED INFO" must always appear on this type of message in the position indicated.

The numeral "1" indicates that this is the first added information sent in connection with the original message. If it is necessary to send further information, the next added information message pertaining to this same case would be numbered "2".

Form No. 3—Correction Message

"467 FILE 8 SP BATAVIA JAN. 11–32 CORRECT 1
TO GA
ORIGINAL DATED JAN. 10–32 DESCRIPTION OF NO. 2
SHOULD READ 26–28–5–9–10–135.
AUTH SERGT. BRANDSTETTER VINT 8–45 PM"

This message correcting the original, takes the same message number and file classification number as the original message which it corrects. The word "CORRECT" must always appear on a correction message fol-

lowing the date. The numeral "1," as in the "Added Information" message, indicates that this is the first correction sent out in connection with this case. If further corrections are necessary, they are numbered consecutively as "2," "3," and up.

Since this message was sent one day later than the original, it is necessary that it contain a reference to the date on which the original message was sent. If the correction was of the same date as the original, there would be no need for this date reference.

Form No. 4—Reply Message

"338 FILE 8 SP NEW HARTFORD JAN. 12–32 REPLY
TO SP BATAVIA
MESA 467 FILE 8 JAN. 10–32.
WE ARE HOLDING CAR AND TWO MEN ANSWERING DESCRIPTION IN YOUR MESSAGE. ADVISE IF YOU WILL SEND FOR THESE MEN.
AUTH SERGT. BROCKMAN SMITH 4–45 AM"

This message is in reply to the original as sent out by SP Batavia. SP New Hartford use their own consecutive message number, since they are originating the reply, but they use the same classification number as that of the original message. The original message number, file classification number, and date are referred to in the body of the message containing the reply. Unless the original is referred to, it is impossible to locate the file, for the original numbers and date are always the controlling items. No matter how many other messages may be sent in connection with this case, and regardless of the number of different message numbers that may be used, the reference must always be to the original numbers and date. The file classification, when once established by the original message, never changes.

Form No. 5—Reply and Added Information Message Combined

"467 FILE 8 SP BATAVIA JAN. 12–32 ADDED INFO 2 & REPLY
TO SP NEW HARTFORD
OUR ORIGINAL DATED JAN. 10; MESA 338 FILE 8 DATE
LIEUT. GEORGE AND COMPLAINANT LEAVING HERE BY AUTO FOR YOUR STATION. HOLD CAR AND PRISONERS.
AUTH CAPT. ROBINSON MC DONALD 8–50 AM"

As this case continues, note how Batavia still uses its original number by means of the use of Added Information and Reply Message Forms. Particularly note that the original message numbers and date are first referred to in the body of the message and then a further reference made to the reply message sent by SP New Hartford.

Form No. 6—Cancellation Message

"521 FILE 8 SP BATAVIA JAN. 13–32 CANCEL
TO GA
VOID 467 FILE 8 JAN. 10–32.
CAR AND SUSPECTS APPREHENDED BY SP NEW HARTFORD
RESULT OF TELETYPE.
AUTH AND SENDER MC DONALD 9–30 PM"

A cancellation message is always identified by the word "CANCEL" in the position shown. Such a message always takes a new message number, but retains the same file classification number as that of the original message which it cancels. The body of a cancellation message must contain a reference to the message number, file classification number, and date of the original message.

Control point operators must send cancellations only over the circuits upon which the original message was sent; otherwise district stations would receive cancellations covering original messages which they had never received. A cancellation message may cancel part or all of an original message. For instance, a message may contain a description of a stolen car and also of the thieves. The car may be found abandoned, but the thieves not yet apprehended. In such a case, a cancellation message is sent covering the car and calling attention to the fact that the thieves are still at large.

Cancellations covering stolen automobiles contain the make, license number, and motor number, as given in the original message. The three-numeral system for filing stolen automobile records used by many police departments, requires this information in cancellations as well as in original messages. In order to facilitate compilation of statistics covering the operation of the system, cancellations include such facts relating to the cancellation as may be available, such as "Recovered by PD Elmira," "Apprehended by SP Hamburg." Where results on a case have been obtained through teletype communication, the words "Result of Teletype," are included in the message.

Special Message Forms—Requests for Data

"221 FILE 2 PD ELMIRA MARCH 3–32
TO SP ALBANY
DATA A–15–05
AUTH SERGT. WILSON EDWARDS 4–50 PM"

"1657 FILE 2 SP ALBANY MARCH 3–32 REPLY
TO PD ELMIRA
MESA 221 FILE 2 DATE A–15–05; JOHN DOE 56 MAIN ST.
CHEMUNG 30
FORD COUPE MOT A–3345567.
AUTH WAX MVB JOHNS 5–06 PM"

Miscellaneous Forms

"26 FILE 1 SP SO. GLENS FALLS FEB. 13–32.
TO GA
FROM FORT EDWARD 29 CHEVROLET COUPE LIC. 4–A–39–56
MOT 234889 SER 3–65–A SPARE WHEELS ON FRONT
FENDER BROKEN WINDSHIELD TRUNK ON REAR.
AUTH MULLEN CP
FORT EDWARD PD BY PHONE CLARK 9–50 PM"

"164 FILE 3 GLOVERSVILLE MARCH 8–32
TO SP ALBANY SP TROY PD NEW YORK CITY
WILLIAM SPRINGER 4441 WEST 138 ST. NEW YORK DRIVING HUPMOBILE SEDAN LIC. 2–Y–34–74 LEFT HIGHWAY ON GLOVERSVILLE-CAROGA LAKE ROAD AND WAS BADLY INJURED. IS NOW IN THE LITTAUER HOSPITAL THIS CITY. CAR IN ARROW GARAGE CAROGA LAKE N. Y. COMPLETE WRECK. INJURED MAN IN DANGEROUS CONDITION. SENT TO SP ALBANY AND SP TROY FOR RECORD PURPOSES. WILL PD NEW YORK CITY PLEASE NOTIFY HIS RELATIVES AND ADVISE.
AUTH TRP. CAREY
SP CAROGA LAKE FISH 11–55PM"

"207 FILE 4 PD POUGHKEEPSIE APR. 1–32.
TO GA
LARGE BLACK SEDAN MAKE UNKNOWN LAST TWO FIGURES IN LIC. ARE 54 TRAVELING SOUTH ON POST ROAD JUST STRUCK PEDESTRIAN IN THIS CITY AND FAILED TO STOP AND REPORT. PLEASE ARREST DRIVER AND ADVISE.
AUTH SHEEDY CP LIEUT. KIMLIN 7–55 PM"

"456 FILE 6 PD SYRACUSE MARCH 8–32
TO GA
MISSING SINCE MARCH 5–32 MARION CECILY 18–5–2–101 RED HAIR BLUE EYES WEARING TAN COAT TRIMMED WITH BROWN FUR. TAN FELT HAT TAN DRESS BROWN SHOES AND STOCKINGS BELIEVED TO BE CARRYING BLACK SUITCASE. LEFT HER HOME SAYING THAT SHE WAS GOING TO NEW YORK TO SEEK EMPLOYMENT HAS NO FUNDS WILL PROBABLY GO ON MAIN HIGHWAY TO GET RIDES BY AUTO. APPREHEND HOLD AND NOTIFY AND WE WILL HAVE PARENTS COME FOR HER. SPECIAL ATTENTION MISSING PERSONS BUREAU NYPD.
AUTH CADIN CP HOLDEN 10–1 PM"

Filing System.—Complete instructions covering the procedure of filing teletype messages have been drafted by the New York State Police, and these instructions are strictly observed by all state police barracks, substations, and patrol posts where teletypewriters are located. This provides a uniform and orderly procedure throughout the state-wide system. No deviation is permitted except as it may be specially authorized by the telegraph bureau. The state police have further recommended the use of their methods by all municipalities connected with the system.

The standard filing cabinet for teletypewriter messages is the Yawman & Erbe seven drawer steel teletypewriter cabinet No. 5716. The guides and dividers for use in such cabinet are the Yawman & Erbe press board guides with metal angular tabs No. P–85–A–2.

All cabinets and guides for state police instrument locations are ordered through the telegraph bureau. Requisitions for supplies in connection with the teletype system are approved by Headquarters only on recommendation of the Supervisor, Telegraph Bureau. Any municipality adopting this filing system must arrange direct with the manufacturers for their supply of cabinets and guides.

The following filing numbers and classifications are in use:

File classification number	*Subject*
1	Stolen automobiles
2	Automobile—information requests
3	Automobile—accidents
4	Hit and run drivers
5	Persons—wanted or escaped
6	Persons—missing

File classification number	*Subject*
7	Burglary
8	Robbery and hold-up
9	Property—lost or missing
10	Property—stolen (larceny), (lost or stolen automobile license plates)
11	Assault
12	Homicide
13	General police information
14	Orders and administrative messages
15	Requests for information (miscellaneous)
16	Other crimes (felonies), (frauds)
17	Other crimes (misdemeanors), (frauds)
25	Miscellaneous messages
26	Test messages—trouble reports

A copy of the foregoing classification list is posted in a conspicuous place at every teletypewriter location. Such classification is closely adhered to in order that the proper file number may be placed on all messages originated by any point on the system. Once a file number has been placed on an original message, such number controls that message and all other messages pertaining to or sent in connection with that case. Since the file number never changes after being assigned to a message, it is obvious that originating operators should be extremely careful to classify their alarms properly, and that operators dispatching reply messages thereto use the same file number as that of the original message.

All messages are trimmed to four and one-half-inch lengths for filing. Cabinets are designed for that size only. An operator, after completing a message, is required to space his paper so that the distance from the top of the message to the break line, made by depressing the key at the conclusion of the message, is approximately five inches. This permits ample margin for trimming purposes. The promiscuous use of the line feed key in spacing out paper causes not only a waste of paper on the sending instrument, but also on all the other instruments associated with it.

Where the contents of a message require a greater space than four and one-half inches, the message is folded to a four and one-half-inch length, with the message number and file classification number remaining visible at the top. An original message always remains at the top of the file, and all subsequent messages are fastened, in the order of their receipt, to the back of the original message. Messages are filed in front of the classification guide.

Teletypewriter Filing Cabinet for Control Points and District Stations

Drawer No. 1.....	1. Stolen automobiles
	2. Automobile—information requests
	3. Automobile—accidents
	4. Hit and run drivers
Drawer No. 2.....	5. Persons—wanted or escaped
	6. Persons—missing
Drawer No. 3.....	7. Burglary
	8. Robbery and hold-up
	9. Property—lost or missing
	10. Property—stolen (larceny), (lost or stolen auto plates)
Drawer No. 4.....	11. Assault
	12. Homicide
Drawer No. 5.....	13. General police information
	14. Orders and administrative messages
	15. Request for information (miscellaneous)
Drawer No. 6.....	16. Other crimes (felonies), (frauds)
	17. Other crimes (misdemeanors), (frauds)
Drawer No. 7.....	25. Miscellaneous messages (legal bulletins), (opinions)
	26. Test messages—trouble reports

Control point instructions.—All control points are supplied with a binder containing control point orders pertaining to the following subjects:

1. Control point filing; master files
2. Message acknowledgments by control point operators
3. Regulations governing the interstate exchange of teletype messages
4. Regulations for the dispatching of cancellation messages
5. Records to be entered in the "Operator's Log Book"
6. Instructions pertaining to "Repeat" signatures on repeated messages
7. List of instrument locations on this and all associated systems
8. Filing instructions for messages received from associated systems
9. Instructions governing the compilation of teletypewriter traffic report and message classification reports
10. Miscellaneous Control Point Regulations; Control Record Book.

Each operating room is required to keep this loose-leaf binder amended to date.

The following regulations and instructions governing the operation of the New York System are especially significant:

1. The utmost care must be exercised in divulging the contents of teletypewriter messages passing over the lines of a confidential nature and for official information only. They should not be given out to other than duly accredited public officers entitled to receive such information. In no case should any information be given concerning the contents of messages originated by municipal police departments connected with the system. The originating municipality is the proper place for the releasing of the contents of such messages and persons asking for such information should be referred to the municipality concerned.

2. All members, particularly switchboard operators, as well as those stationed at points where teletypewriters are located, should carefully observe this order. The practice of permitting persons not officially concerned with the system to remain in the vicinity of instruments, thereby reading the messages, should be stopped at once.

3. The records of revolver permit applications on file at Albany Headquarters are likewise confidential records and information concerning the contents thereof is to be given only to police agencies or proper public officials entitled to receive it.

4. Requests for information concerning revolver permit applications or teletype messages will be granted when application is made in person, and then only after careful verification of credentials or authority of the applicant. Requests made by telephone from police agencies or officials will be noted, but the information will not be given until the telephone call has been verified as authentic by a call back to the requesting agency.

5. The success of the system will depend in no small degree upon strict compliance with orders and regulations governing its use. The correct filing of messages is most important. All regulations, as set forth in the published pamphlet, or in subsequent orders as may be issued from time to time, concerning the filing of such messages must be followed in every detail.

6. The teletype system will carry information to the instruments, but unless the information is properly distributed for use by the men working on the highways, at substations, patrol posts, and other points, it can be of little value in the prevention and detection of crime or the apprehension of criminals.

All patrols should familiarize themselves with instrument locations, and arrange to get information as it is being sent over the system, which might prove to be of value in their particular territory. Each member of the State Police must carry a memorandum book as part of his regular equipment, to be constantly used for the purpose of recording police information received by teletype or otherwise. These memorandum books

will be inspected by officers making patrol inspections and checked to see that they are being kept in such a manner as to be useful.

7. The following information must be sent by teletype as soon as practicable, for the information of Albany Headquarters:

(a) All homicides

(b) Reports of all personal injuries to members of the State Police

(c) Reports of all serious or fatal accidents in which members of the State Police or troop equipment is in any manner involved

(d) Reports of the use of firearms by members of the State Police, which use results in injury to any human being

(e) Reports of all fatal or serious accidents, of any nature whatsoever, wherein any person has died, or is likely to die, as a result thereof

(f) Reports of all serious explosions for the information of the State Labor Department

(g) Reports of all airplane accidents

(h) The reports specified herein should in no way supersede or delay the prescribed reporting for such occurrences as are now in force and effect.

The practical advantages which modern teletypewriter systems offer to police service are many. Aided by the indispensable telephone and by a fleet of radio-equipped patrol cars, the teletypewriter in the hands of a modern police force becomes one of its most important tools. It provides a communication facility with which simultaneous transmission of a message to a number of locations is possible. Neither the number of such locations nor the distance between them is any barrier.

APPENDIX 7

Exhibits from Files of the New Jersey State Police Teletype System

Series A

HBG PA 1–30–33 4–31 PM MJW 1–431
TO INSPECTOR O'BRIEN
NEW YORK CITY POLICE
WE HAVE IN OUR POSSESSION A PIERCE ARROW SEDAN COLOR BLUE NEW YORK LICENSE 3N 3897 IT IS A 1925 OR 1926 MODEL, HAS INITIALS ON DOOR "E.R.S." THIS CAR HAS A BULLET-HOLE IN WINDSHIELD. KINDLY ADVISE OWNER AND OBLIGE.

CAPT. OF DETECTIVES RUPP HARRISBURG, PENNA
PHILA PA RELAYING

TRENTON NJ TO NEWARK NJ 1–30–33
FOLLOWING MESSAGE RELAYED
TO NY CITY POLICE
WE HAVE IN OUR POSSESSION A PIERCE ARROW SEDAN COLOR BLUE REG 3N 3897 NY IT IS A 1925 OR 1926 MODEL. HAS INITIALS ON DOOR "E.R.S." THIS CAR HAS A BULLET-HOLE IN WINDSHIELD. KINDLY ADVISE OWNER OF ABOVE CAR AND OBLIGE.

CAPT. OF DETECTIVES RUPP HARRISBURG PENNA
4–48 PM RB
(HGB PA MISC–1–431)

NEWARK NJ TO HAMMONTON NJ 1–31–33
FOLLOWING MESSAGE RELAYED RE HBG PA MISC 1–431
1–30–33
TO CAPT. OF DETECTIVES RUPP HBG PA—RE PIERCE ARROW REG. 3 N 3897 NY
NOT REPORTED STOLEN TO THIS DEPARTMENT. OWNER'S NAME NOT AVAILABLE AT THIS TIME. AS SOON AS WE ARE ABLE TO OBTAIN IT SAME WILL BE NOTIFIED.
2–44 AM JMC NY CITY POLICE

NEWARK NJ TO HAMMONTON NJ 2–1–33
FOLLOWING MESSAGE RELAYED RE HBG PA MISC 1–431
TO HARRISBURG PA POLICE
PIERCE ARROW SEDAN REG 3N3897 NY REGISTERED TO DAVID P. GREGG 44 E. 44TH ST N. Y. C. HE IS NOT KNOWN AT THAT ADDRESS. HAS BUSINESS ADDRESS OF 1104 SOUTHERDASH AVE CHICAGO ILLINOIS.
3–12 PM JM NY CITY POLICE

SERIES B

MORRISTOWN NJ TO TRENTON NJ 1–5–33
ATTENTION AUTO BUREAU
THE FOLLOWING CAR WAS FOUND ABANDONED AT PHILLIPSBURG NJ JANUARY 3RD WITH SHEARED LEFT AXLE. CHEVROLET SEDAN REG. 5–L–2500 NY MOTOR 2942737 SERIAL 2 AE 121701. KINDLY ADVISE IF THIS CAR HAS BEEN STOLEN AND HAVE OWNER NOTIFIED.
8–33 PM MDT PHILLIPSBURG NJ POLICE

TRENTON NJ TO NEW YORK CITY 1–5–33
FOLLOWING MESSAGE RELAYED
NY CITY POLICE AUTO BUREAU.
THE FOLLOWING CAR WAS FOUND ABANDONED HAD SHEARED LEFT AXLE CHEVROLET SEDAN REG. 5-L-2500 NY MOTOR 2942737 SERIAL 2 AE 121701. KINDLY ADVISE IF THIS CAR WAS REPORTED STOLEN ALSO HAVE OWNER NOTIFIED. CAR IS NOW IN THE CUSTODY OF THE PHILLIPSBURG NJ POLICE.
NJ STATE POLICE AUTO BUREAU TRENTON NJ
9–14 PM LEP

NEWARK NJ TO TRENTON NJ 1–6–33
FOLLOWING MESSAGE RELAYED REF MESSAGE OF 9–14 PM 1–5–33
TO N. J. S. P. AUTO BUREAU TRENTON NJ—CHEVROLET COACH REG 5–L–2500 NY MOTOR 2942737 STOLEN ON 1–2–33 OWNER MANUEL HELD, 600 EAST 21ST ST. BROOKLYN NY HAS BEEN NOTIFIED AND WILL CLAIM HIS CAR.
12–26 AM JM NY CITY POLICE

TRENTON NJ TO MORRISTOWN NJ 1–6–33
FOLLOWING MESSAGE RELAYED REF YOUR MESSAGE OF 8–33 PM 1–5–33
TO PHILLIPSBURG NJ POLICE
CHEVROLET COACH REG 5–L–2500 NY MOTOR 2942737 STOLEN ON 1–2–33 OWNER MANUEL HELD, 600 EAST 21ST ST BROOKLYN NY HAS BEEN NOTIFIED AND WILL CLAIM HIS CAR.
12–30 AM CAV NY CITY POLICE

SERIES C

NEWARK NJ TO TRENTON NJ
INFORMATION REQUEST 1–31–33
STATE POLICE BAYSHORE LONG ISLAND NY REQUEST INFORMATION ON REGISTRATION B–63103 NJ MOTOR A–3462952 AND IF REPORTED STOLEN.
6–22 PM GCD.

TRENTON NJ TO NEWARK NJ 1–31–33
B–63103 NJ ISSUED TO KURT SCHWERN 5 WARWICK AVE PALISADE NJ 1930 FORD COUPE MAROON MOT 2462952. AUTO BUREAU FILES SHOW ABOVE CAR REPORTED STOLEN ON TRENTON NJ GB–1395 NEWARK NJ 1476. WHEN ABOVE CAR WAS REPORTED STOLEN IT BORE REGISTRATION B–73072 NJ MOTOR 3462952.
6–35 PM LEP N. J. S. P. AUTO BUREAU TRENTON NJ.

SERIES D

TRENTON NJ TO HAMMONTON NJ 1–28–33
A PHONE CALL WAS RECEIVED AT TRENTON HDQRS FROM OFFICER TURNER SPRINGFIELD PENNA POLICE MONTGOMERY COUNTY PA. REQUESTING INFORMATION REGARDING AN UNIDENTIFIED MAN WHOSE BODY WAS FOUND IN BIG TIMBER CREEK RUNNEMEDE NJ EITHER YESTERDAY OR THE DAY BEFORE. OFFICER TURNER REQUESTS DESCRIPTION AND PRESENT WHEREABOUTS OF BODY SO THAT IT MAY BE VIEWED. ADVISED OFFICER TURNER THAT WE WOULD SECURE THE INFORMATION AND FORWARD IT VIA TELETYPE A THROUGH THE JENKINTOWN PENNA POLICE WHICH IS THE CLOSEST POLICE DEPARTMENT HAVING TELETYPE.
REPLY IS REQUESTED AS SOON AS POSSIBLE AS OFFICER HAS AN INTERESTED PARTY WAITING FOR THIS INFORMATION.
8–37 AM JMS TRENTON TELETYPE BUREAU

HAMMONTON NJ TO PHILA PA 1–28–33

FOLLOWING MESSAGE RELAY

TO JENKINTOWN MONTGOMERY CO PA POLICE
ATTENTION OFFICER TURNER SPRINGFIELD PA POLICE
(PLEASE RELAY)
REF YOUR PHONE CALL THIS DATE. BODY OF MAN FOUND IN BIG TIMBER CREEK RUNNEMEDE NJ HAS BEEN IDENTIFIED AS THAT OF JOHN FLYNN AGED 50 YEARS OF BELL ROAD BELMAWR NJ WHO WAS LIVING WITH A FAMILY NAMED OLLEK AT THAT ADDRESS. THIS MAN WAS A DRUNKARD AND DIED OF ALCOHOLISM AND EXPOSURE. IDENTIFICATION MADE BY WARREN BOPP OF BELL ROAD MT. EPHRAIM NJ AND MR. OLLEK OF BELMAWR NJ.

STATE POLICE TRENTON NJ

9–56 AM JWS

SERIES E

NEWARK NJ TO HAMMONTON NJ 1–3–33

FOLLOWING MESSAGE RELAYED

TO PHILA PA POLICE—CLIFFORD LA MAR ALIAS "NUNIE" NEGRO OF 1714 FOLSON ST PHILA PA AGE 23 5′ 11″ 136 LBS SINGLE OCCUPATION CHAUFFEUR ARRESTED HERE CHARGED VAGRANCY, STATES HE IS WANTED YOUR CITY FOR BURGLARY ELKS HOME LOCATED ON CHRISTIAN ST DURING YEAR 1930. ADVISE IF WANTED.

NY CITY POLICE

12–26 AM GD

TRENTON NJ TO NEWARK NJ 1–3–33
FOLLOWING MESSAGE RELAYED
RE YOUR MESSAGE OF 12–26 AM 1–3–33
JOHN J. OBRIEN CHIEF INSPECTOR NY CITY
ANSWERING YOUR TELETYPE MESSAGE THIS AM CONCERNING CLIFFORD LA MAR ALIAS "NUNIE" PLEASE BE ADVISED THAT THIS MAN IS WANTED BY OUR DEPARTMENT ON A CHARGE OF HOLDUP AND ROBBERY ON MARCH 11TH 1931. HOLD THIS MAN AND LETTER AND WARRANT WILL FOLLOW. THANKS

JOSEPH LE STRANGE ACT. SUPT. POLICE PHILA.

7–55 AM CAV

NEWARK NJ TO HAMMONTON NJ 1–6–33
RE OUR 12–26 AM 1–3–33
TO PHILA PA POLICE—CLIFFORD LA MAR ALIAS "NUNIE" SENTENCED THIRTY DAYS WORK HOUSE CHARGE VAGRANCY. DEMANDS EXTRADITION. SUGGEST YOU FORWARD PAPERS AND WILL ADVISE WHEN TO SEND OFFICERS. NY CITY POLICE
2–07 PM JM

Series F

NEWARK NJ TO HAMMONTON NJ 1–3–33
FOLLOWING MESSAGE RELAYED.
TO PHILA PA POLICE
NOTIFY PARENTS OF ESTHER BARSKY 1324 NORTH FRANKLIN ST & LENA GAN 901 NORTH 8TH ST. THAT THEY ARE ARRESTED AS RUNAWAYS & REMOVED TO MANHATTAN CHILDRENS SOCIETY 105TH ST & 5TH AVE. ADVISE.
12–10 AM GD NY CITY POLICE.

NEWARK NJ TO NEW YORK 1–3–33
FOLLOWING MESSAGE RELAYED REF YOUR 12–17 AM MESSAGE
TO NY CITY POLICE—PARENTS OF ESTHER BARSKY 1324 N. FRANKLIN ST AND LENA GAN 801 NORTH 8TH ST HAVE BEEN NOTIFIED AND WILL GO TO NEW YORK FOR THEM TODAY
JOSEPH LE STRANGE ACT. SUP. POLICE PHILA PA.
8–08 AM JMC

Series G

NEWARK NJ TO TRENTON NJ 1–1–33
SOUTH ORANGE NJ POLICE REQUEST INFORMATION ON REG. E–95419 NJ.
4–52 PM GD

TRENTON NJ TO NEWARK NJ 1–1–33
E–95419 NJ ISSUED TO THERESA MILOSY 138 IRVING AVE SOUTH ORANGE NJ 1930 FORD TUDOR GREEN MOTOR 2832776.
4–56 PM LEP

Series H

NEWARK NJ TO NEW YORK 1–30–33
STATE POLICE ALPINE NJ REQUEST FULL INFORMATION ON REG. 6 Y 7324 NY.
5–27 PM GD

NEWARK NJ TO MORRISTOWN NJ 1–30–33
TO STATE POLICE ALPINE NJ
REG 6 Y 7324 NY ISSUED TO URBAN A JORDAN 66 ST. NICHOLAS AVE NY CITY FOR A 1931 BUICK SEDAN MOTOR 2750308. NO RECORD OF LOSS
7–24 PM GD

Series I

NEWARK NJ TO TRENTON NJ INFORMATION REQUEST 1–30–33
EAST ORANGE NJ POLICE REQUEST INFORMATION ON CONVICTIONS FOR DRUNKEN DRIVING AGAINST CHARLES A. COFFEY 19 FAIRMOUNT TERRACE EAST ORANGE NJ DRIVERS LICENSE 1093984.
5–26 PM GD

TRENTON NJ TO NEWARK NJ 1–30–33
CHARLES A. COFFEY 19 FAIRMOUNT TERRACE E. ORANGE NJ HAD HIS DRIVERS LICENSE REVOKED OCTOBER 10TH 1928 FOR DRUNKEN DRIVING BY JUDGE JOHN C. HAME OF NEWARK NJ DRIVERS LICENSE RESTORED OCTOBER 10TH 1930. NO RECORD OF A RECENT REVOCATION.
5–46 PM.

APPENDIX 8

Alarm-System Equipment

Many meritorious alarm devices which may be adapted to the solution of the problem of alarm protection are available in the market. The following general specifications cover alarm-system equipment already approved by the Underwriters' Laboratories and now to be had from manufacturers ready for installation. Although this list is by no means complete, it will afford some indication of the range of alarm equipment that is being manufactured at the present time. Lists of inspected appliances—electrical, fire protection, gas, oil, and miscellaneous, automotive, accident hazard, and burglary and holdup protection—are published regularly; also a list of approved heat- and sound-sensitive detectors, floor traps, and various types of relays, gongs, sirens, and so forth. These published lists also give the name of the manufacturer of each approved device or system. As has been stated, it is the recommendation of police officials generally that no alarm equipment of any kind should be installed until approved by this agency. Any desired list may be obtained by addressing either the main office, or one of the branch offices of the Underwriters' Laboratories.

BANDIT-RESISTING ENCLOSURES

In order that the insured may be eligible for a certificate, installations of bandit-resisting enclosures shall completely cover all hazardous points. The principal requirements of a complete installation are as follows:

The work space shall be separated from the lobby, from exposed officers' quarters, and from public balconies and stairways commanding a view of the work space by bullet-resisting construction. All essential parts of the enclosure, including glass, armor plate, gun ports, deal trays, package receivers, etc., shall be of listed design capable of resisting projectiles from hand pistols and revolvers up to and including 45 caliber and shot from sawed-off shot guns. The bullet-resisting

construction shall extend to a height of at least seven feet above the floor or landings, or to the ceiling.

If the walls of the enclosure do not extend to the ceiling, the top of the cages or the opening between the enclosure and the ceiling shall be covered with mechanical guards to protect against a bandit vaulting over the fixture. A sufficient number of gun ports shall be installed and so placed as to give employes within the work space command of the entire public lobby.

Movable doors and gates in the enclosure shall be equipped with door closers and with automatic locking devices which cannot be released from the interior or exterior except by authorized employes. To provide for the reception of payrolls and bags of currency, at least one bullet-resisting package receiver shall be provided. Windows or other movable openings which lead directly into the active work space shall have bullet-resisting coverings to a height of at least seven feet from the sidewalk or walkway leading to the opening. All movable openings, such as windows and skylights, which give direct access from the street or adjoining premises to the working quarters, shall be equipped with suitable bars or screens to prevent entry during working hours. Coal hole covers, ash pit doors, rear entrance doors, and similar openings which give access from the outside of the premises to the working quarters shall be securely locked or barred.

BULLET-RESISTING MATERIALS

Materials and devices classified as bullet-resisting are tested for resistance to penetration or passage of a limited number of projectiles from small arms and shot guns fired at close range. Regulation small arms employing domestic ammunition, with either lead or metal-cased projectiles, having rated muzzle velocity not exceeding 1400 feet per second and rated muzzle energy not exceeding 460 foot pounds are included in test equipment. Such materials as pass these tests are considered suitable for use in the construction of complete bandit-resisting enclosures.

BURGLAR-ALARM SYSTEMS

Burglar-alarm systems are investigated with respect to equipment, method of installation, and character of maintenance service which the equipment receives.

Centralized system (bank vaults).—A bank safe central office burglar alarm system consists of electrical conductors, contacts, or other detectors applied to vault walls, floor, ceiling and door so as to signal automatically to the central office in the event of unauthorized entry of the protected vault. Guards are dispatched to investigate the cause of the alarm. The systems are maintained and inspected periodically by the operating company.

Local bank vault alarm system.—A bank vault local burglar alarm system consists of electrical conductors, contacts, or other detectors applied to vault walls, floor, ceiling and door in conjunction with suitable electrical control units, so as to operate an outside, loud-sounding gong or siren, in the event of unauthorized entry of the protected vault.

HOLDUP-ALARM SYSTEMS

Manually operated.—This type of system generally consists of buttons or other forms of signaling stations for installation at various points of a banking room and connection to an outside gong through suitable control apparatus. They are intended for protection against interior robbery, and the systems are required to be installed in accordance with the requirements of the National Electrical Code for low-potential light and power circuits.

One such system comprises control apparatus, alarm gongs and contactor stations. The contactors, gongs, and relays in the control unit are normally supervised by a small current flow and are arranged so that operation of a contactor station causes continuous sounding of the gong and trouble bell until reset. The system is placed on and off duty by a switch in a locked and protected control cabinet.

Semiautomatic type.—One form of semiautomatic alarm system employs an open and closed circuit signaling network, comprising control apparatus, electrically and mechanically controlled money drawer and door locks, electric vault door and grill locks, electric contact moulding and remotely located alarm units.

Another embraces a signaling and supervisory system comprising apparatus to control and supervise the entrances to a bandit-resisting enclosure, a local control cabinet, two remote-alarm stations, manually operated initiating stations, and a semiautomatic alarm initiating high tension barrier system.

MESSENGER BAG ROBBERY ALARM DEVICE

Protection of messengers against holdup probably involves more of the human element than any other hazard. The uncertainty as to amounts carried, and as to persons thus engaged, has apparently kept the losses from messenger robbery down to relatively small figures. The most widely accepted means of safeguarding quantities of valuables in transport is the armored car equipped with armed and highly trained guards. The use of messenger bags equipped with alarms, gas, and other similar apparatus will depend upon the trend in this branch of crime. One such device listed by the Underwriters' Laboratories is thus described.

A mesh-lined leather bag containing mechanism which automatically locks the bag, produces a series of detonations to attract attention, and emits streams of tracer smoke to assist pursuit if the bag is snatched from its carrier. This is intended for use in the transportation of money or securities in cities.

MERCANTILE PREMISES ALARM SYSTEMS

The extent of alarm protection installed on mercantile premises is classified as Installation 1, 2, or 3 central station alarm, or Installation 2 or 3 local alarm, in accordance with the following definitions:

Installation 1.—Completely protecting all windows, doors, transoms, skylights, and other openings leading from the

premises, and all ceilings, floors, and hall, partition, and building walls enclosing the premises, except building walls which are exposed to street or public highway, and except that part of any building wall which is at least two stories above roof of an adjoining building.

Installation 2.—Protecting with traps all inaccessible windows, and with screens (or foils and traps) all accessible windows (except stationary show windows), doors, transoms, skylights and other openings, leading from the premises and protecting all ceilings and floors not constructed of concrete, and all hall, partition, and party walls enclosing the premises.

Installation 3.—Protecting with screens (or foils and traps) all accessible windows (except stationary show windows), doors, transoms, skylights, and other openings leading from the premises.

Centralized system.—A mercantile premises central office alarm consists of electrical conductors, contacts, or other detectors on doors, windows, skylights, walls, ceilings, and floors of mercantile establishments, connected so as to signal automatically to a central office in the event of unauthorized entry to the protected premises. Guards are dispatched to investigate the cause of the alarm. The systems are maintained and inspected periodically by the operating company. Combination systems are also listed which simultaneously sound an outside gong and signal a central office.

Local mercantile alarm.—A mercantile premises local alarm consists of electrical conductors and contacts on doors, windows, skylights, walls, ceilings, and floors in conjunction with suitable electrical control units arranged automatically to operate an outside loud-sounding gong or siren in the event of unauthorized entry into the protected premises. Watchmen's service furnished by an organized patrol force is considered as a desirable adjunct to gong alarm systems. Neither the character nor presence of such service enters into the classification of the equipment by Underwriters' Laboratories.

The extent of protection installed on premises with local

mercantile alarm connection is classified as Installation No. 2 or 3, as follows:—

Installation 2.—Protecting with traps all inaccessible windows and with screens (or foil and traps) all accessible windows (except stationary show windows), doors, transoms, skylights, and other openings leading from the premises, and protecting all ceilings and floors, not constructed of concrete, and all hall, partition, and party walls enclosing the premises.

Installation 3.—Protecting with screens (or foils and traps) all accessible windows (except stationary show windows), doors, transoms, skylights, and other openings leading from the premises.

Mercantile safe alarm systems.—The extent of protection on safes is classified as "complete" or "partial" protection, as follows:—

Complete protection.—Protecting with approved devices the top, bottom, all sides, and doors of safes.

Partial protection.—Protecting with approved devices the safe door or lock-and-bolt mechanism.

Centralized system.—A mercantile safe central office alarm consists of a network of electrical conductors and contacts applied to the safe, and arranged to transmit automatically a signal to an office of the operating company, from which trained and armed guards are dispatched, if an unauthorized opening or entry into the vault is attempted. Such installations are maintained and inspected periodically by the operating company.

Local mercantile safe alarm systems.—A mercantile safe local alarm consists of electrical conductors and contacts applied to the safe in conjunction with suitable electrical control units, so as to operate automatically a loud-sounding gong on the outside of the building in the event of unauthorized entry into or opening of the protected safe.

Underwriters' Laboratories also lists approved central office alarm units, consisting of a central station switchboard and subscribers' units. These units are designed for use in

connection with standard central office alarm system installations.

Cable lining in vault doors.—An approved system of lead-covered wires installed behind the outside finish plate of heavy solid round and square doors. Cables are run in two circuits on centers not exceeding three inches, with ends projecting for connection to alarm system installed on the vault.

Electric protection for night depository entrances.—An arrangement of multiple closed circuit lining and contacts installed at the factory in rotary night depository entrances. Linings are of the sealed envelope type, carry two closed circuits, and are arranged to cover mouth of chute with the rotor in either its open or closed position.

Gas and chemical systems.—When properly installed and maintained, gas protection systems are also eligible for certification.

Safe protection.—A system of tension wires, combination attachments, shearing devices, and firing mechanism for installation on all types of safes (with the exception of listed fire-resistive safes, in which gypsum is used as a binder for the insulation, and fur safes) having provision for storing delicate mechanism in practically gas-tight containers. The device is designed to release tear gas in the event of a burglarious attack on the combination lock. It is required that gas charges be renewed at least once every three years.

Vault protection.—A system of tension wires and combination attachments for installation on the interior of light vault doors, or a system of tension wires and thermostats on vault doors 4 inches or more in thickness, used in connection with approved relocking device which aligns with gas shells and firing mechanism mounted in the vault vestibule. In operation, the system is designed to relock door and release gas within vault if burglarious attack is made at any point on vault door.

Interior robbery protection.—One such system consists of gas guns connected electrically in series in a fully supervised circuit to primary batteries and control units, so that a cloud

of incapacitating gas may be discharged instantly from one or more paying windows by the operation of a single hand or foot control. These systems are inspected annually by the manufacturer and gas charges renewed at intervals not exceeding three years.

APPENDIX 9

Miscellaneous Record Forms

Complaint Forms

A convenient form employed by a number of departments for recording complaints is 5×8 inches in size, with the desired data so arranged as to accommodate the various types of crimes and complaints reported to the police for investigation.

The illustrations given on pages 538–542, below, indicate a type of form that may be used for recording the original information at the time it is received over communication lines at the complaint desk. All reports and complaints received by the department for investigation, after being assigned and recorded properly on the original complaint forms, are given a consecutive file number and then routed to the records division.

In accordance with modern police practice, the investigating officer assigned to a case is required to file promptly written reports covering all details of the investigation. Such reports on a particular case are given the serial number of the original complaint, to which they are later attached in chronological sequence, in order that all details and information connected with the investigation may be together in one complete file for reference purposes.

In all departments provided with beat telephone facilities, patrol officers are required to report in at regular intervals, and it is necessary that a permanent record be made of these calls, together with other pertinent information connected with the activities of the individual officer.

The rules and regulations of the Federal Communications Commission require that an accurate record be kept of station operation, including the date and time of each transmission, name of person operating the transmitter, frequency of transmission, power used, and other related information. This record is mandatory. The rules and regulations further

Original Complaint Forms—Miscellaneous

Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

MISC. REPORTS and COMP. **Classification**

Victim | Investigators
Address | Ph. | Re-assigned to | Date
Where Committed | C P B

Suspects or Responsible | M | F
When Committed

How Committed

Reported by | Date warrant issued
Address | Ph. | Circulars sent to
Reported to | Cancelled on Bull. by | Date
Time Reported | Other complaints
How reported: Phone ☐ Person ☐ Letter ☐ Telegram ☐ Teletype ☐ | Similar M. O.
REMARKS | Auto used | Firearm used
Beat officer received complaint by: Box ☐ Radio ☐ Light ☐
On view ☐ Radio and Box ☐ At station ☐ Citizen ☐

Local Circulars by | Disposition Code | Date | By

Original Complaint Form—Robbery

Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Crime	**Robbery**	**Classification**	**No.**
Name		Investigators	
Address		Person Arrested	
Where Committed		Alias	
Person and Property Attacked		Date of Arrest	
How Attacked		Arrested by	
Means of Attack		Previous Record	
Time of Attack			
Object of Attack		Previous Complaints	
Trademark			
Reported by		Date of Examination	
Address		Record to District Attorney	
Reported to		Date of Trial	
Time Reported		Result of Trial	
Person Suspected		Removed to County Jail by	
Why Suspected		Date of Sentence	
Witnesses		Sentence	
Description of Suspect		Criminal History	
Hair	Build	Recovered by	
Eyes	Beard	Date Recovered	
Height	Nativity	Where Recovered	
Weight	Occupation	Circular sent to	
Age	Complexion	Cancelled on Bulletin	
Marks		Remarks	
Dressed			

Original Complaint Form—Burglary

Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

BURGLARY **Class**

Victim	Investigators
Address Ph.	Re-assigned to Date
Bus. or Inst. Ph.	Suspects or Responsible M F
Where Committed C P B	
Time of Attack Day	
Person or Prop. Attk'd	Previous Records
How Attacked	
Means of Attack	Warrant issued
	Circulars ☐ Local ☐ Bay ☐ Coast ☐ U. S.
Objects of Attack	By Dates
Trademark	Similar Mo's
Time Reported	Arrested by Date
Auto Used Gun Used	Other reports
Reported by Ph.	
Address	Prop. rec. by ☐ Partial Complete
Reported to Made by	Where rec. Date
How Reported: ☐ Ph. ☐ Person ☐ Letter ☐ Wire ☐ Teletype	Dispn. Code by Date
Beat officer ntfd. by ☐ Light ☐ Radio ☐ Station ☐ Citizen ☐ Bulletin	Other officers detailed as follows:
☐ Warrant ☐ Outside Dept. ☐ On View ☐ Box	
Depts. notified by	
By ☐ Radio ☐ Phone ☐ Wire ☐ Teletype ☐ Contact ☐	
Canc. ☐ Radio ☐ Phone ☐ Wire ☐ Teletype ☐ Contact ☐	Remarks
Date By Officer	
Bulletin Cancellation by Date	
Record to D. A. by Date	

Original Complaint Form—Lost and Found

Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

LOST AND FOUND **No.**

Subject					Classification	
Name					Reported by	
Address			Ph.		Address	
						Ph.
Where Lost or Found		C.	P.	B.	Reported to	
					Time Reported	
When Lost or Found					Officer	
How Lost or Found					Where Recovered	
					Recovered by	
					Date Recovered	

DESCRIPTION

Disposition Code Date By

Original Complaint Form—Casualty

Jan.			Feb.			Mar.			Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

CASUALTY REPORT **No.**

Kind	Classification
Name	Number Injured
Address Ph.	Number Died from Injury
	Number Killed
Where Occurred C. P. B.	Removed to
	Removed by
When Occurred	Attended by
How Occurred	Extent of Injuries
	Ambulance Crew:
Reported by	Officer
Address	Witnesses
Reported to	
Time Reported	
Person Responsible	
Address	

REMARKS

Disposition Code Date By

Patrol Time Sheet

DAILY ATTENDANCE RECORD_____ **PLATOON** **Date** **Day**

RANK	NAME	Radio No.	Ring	Flash	D.O.	Post	On Duty										MEAL TIME From	MEAL TIME To	Off Duty
Chief																			
Capt.																			
Lieut.																			
Desk Sgt.																			
Field Sgt.																			

Jail Inspected by Sergeant — JAIL INSPECTIONS 1st: Time 2nd: Time: 3rd Time 4th: Time

Patrol Inspected by Sergeant

Ambulance Inspected by Sergeant — Prisoners Received — Released — Turned Over to — Platoon

Remarks:

Voluntary Special Duty

Court

Mandatory Special Duty

Overtime

Desk Officer

(If additional space is needed for further remarks concerning any of the above items, use reverse side of sheet, indicating this by "SEE OVER" on the line to which it refers.)

Radio Log

K. V. P.—DALLAS POLICE DEPARTMENT RADIO LOG

	TIME OF BROADCAST	TIME RESPONDING	SCOUT NO.	REMARKS	DISPOSITION	TIME REPORTED
	8:40 p.m.	2 min.	34	3710 Hawthorne—Prowler	No arrest	8:50 p.m.
	9:11 p.m.	1 min.	42	Jefferson & Lancaster—Disturbance	1 arrest	9:39 p.m.
	9:40 p.m.	3 min.	35	Live Oak & Hawkins—Investigation	1 arrest	10:20 p.m.
	10:11 p.m.	2 min.	42	Call Headquarters (Sent to M-D Bldg., investigation)	No arrest	10:38 p.m.

Date 193 from .M. to .M. Desk Sergeant

Relief from .M. to .M. Desk Sergeant.

Relief from .M. to .M. Desk Sergeant

Radio Patrol Car Daily Report

POLICE DEPARTMENT
City of Dallas

DISTRICT NO.....
SCOUT CAR NO.....DAILY OPERATING REPORT FOR.....193.....
SPEED READING..... .....M .....DRIVER
SPEED READING..... .....M .....AID

(POLICE CALLS FOR OTHERS)

TIME	TIME	TIME	TIME	TIME	TIME	TIME	TIME	TIME	TIME	TIME

(POLICE CALLS FOR THIS CAR)

TIME	LOCATION	NATURE OF CALL	TIME ARRIVED AT LOCATION	TIME REPORTED TO HD. QRS.

Enter in top section time of each call for other POLICE cars and time of test calls for all POLICE cars. Enter in bottom section time and all details of calls for your car. File this report with Desk Sergeant at headquarters upon reporting off duty. Record speedometer reading of car at beginning and end of duty.
Car Radio was OUT of service from:

A.M. A.M.
.....P.M. to .....P.M. .....
Reason

A.M. A.M.
.....P.M. to .....P.M. .....
Reason

(REVERSE)

Give below time and details of investigations and arrests made on observations or on information from sources other than Radio. If any such investigation or arrest caused delay in answering a Radio call or failure to receive Radio call, make special reference to it under the heading of Remarks.

REMARKS:

FIRE, POLICE & RADIO ALARM SYSTEM

SQUAD CAR RECORD

Receiver Servicing Record

Squad No.....
Car No.....Make.....Model.....Engine No.....
Set No. Make Inst. by Date Card No.

DATE	TIME			TOTAL TIME O.R.S.	MILEAGE	TUBE NO. & STAGE						BAT. CHGS.			SERVICE	BY	REMARKS
	O.R.S.	IN	OUT			1 RF	2 RF	3 RF	DET	1 AUD	2 AUD	A	B	"B" LIFE			

FIRE, POLICE & RADIO ALARM SYSTEM

TUBE RECORD

Receiver Servicing Record

TYPE.....MAKE.....TUBE NO.....
PURCHASED FROM DATE

SQUAD NO.	DATE		MILEAGE		LIFE		STAGE	CAUSE OF FAILURE	DATE REPL.
	IN	OUT	IN	OUT	DAYS	MILES			

state that ". . . this information shall be made available upon request by authorized Government representatives."

Although the Commission does not prescribe any definite form that this record shall take, the record form shown on this page is typical of those used by the police.

A number of departments, including Baltimore, Md.; Dallas, Tex.; Dayton, Ohio; Grand Rapids, Mich.; St. Paul, Minn.; Los Angeles, Calif.; and Denver, Colo., require the crews of radio-equipped patrol cars to file daily reports at the close of each tour of duty. Such reports contain information concerning crime broadcasts received, time of receipt, running time, efficiency of receiver operation, nature of any re-

Transmitter Service Record

LANSING POLICE DEPARTMENT
Radio Station WPDL

Operators Shift Report _____ Date _____

METER READINGS.

SPEECH PANEL	TRANSMITTER PANEL
Mic. Current	Buffer Plate Current
No. 1. 427	Buffer Grid Current
No. 2. 427	Osc. Buf. Fil. Volts
Plate Current 445	Osc. R. F. Tank Cur.
Volume Level	Osc. Plate Current
	Mod. Amp. Grid Cur.
Tube Replacements	Mod. Amp. Plate Cur.
Repairs	Antenna Current
Adjustments	Mod. Amp. Fil. Cur.
	Mod. Plate Current
	Buffer Tuning
	Oscillator Tuning
	Mod. Amp. Tuning

Remarks:

Operator on Duty _____

Time Readings Were Taken _____

Daily Consolidated Radio Report

K G P X—DENVER POLICE **Radio Report by Shift** Date_____ 193____

Detail 1. 4 a.m. to 12 noon

	10	11	12	13	20	21	22	23	24	30	31	32	33	34	40	41	42	43	44	50	51	52	53	54		Totals
Homicides																										
Burglary																										
Larceny																										
Robbery																										
Investigations																										
Drunks																										
Disturbance																										
Prowlers																										
Ambulance Calls																										
Fire Alarms																										
Lost or Missing																										
Auto Accidents																										
Suicides																										
Autos Stolen																										
Autos Recorded																										
Pick-Ups Reported																										
Pick-Ups Recovered																										
Descriptions																										
Station Calls																										
Other Calls																										
Out of Service																										
Arrests Made																										
Totals																										

Monthly Consolidated Radio Report

K G P X—DENVER POLICE **Monthly Report on Radio Cars** Date_____ 193____

	District No. 1												District No. 2												Total
	12 m.– 2 a.m.	2 a.m.– 4 a.m.	4 a.m.– 6 a.m.	6 a.m.– 8 a.m.	8 a.m.–10 a.m.	10 a.m.–12 p.m.	12 p.m.– 2 p.m.	2 p.m.– 4 p.m.	4 p.m.– 6 p.m.	6 p.m.– 8 p.m.	8 p.m.–10 p.m.	10 p.m.–12 p.m.	12 m.– 2 a.m.	2 a.m.– 4 a.m.	4 a.m.– 6 a.m.	6 a.m.– 8 a.m.	8 a.m.–10 a.m.	10 a.m.–12 p.m.	12 p.m.– 2 p.m.	2 p.m.– 4 p.m.	4 p.m.– 6 p.m.	6 p.m.– 8 p.m.	8 p.m.–10 p.m.	10 p.m.–12 p.m.	
Homicides																									
Burglary																									
Larceny																									
Robbery																									
Investigations																									
Drunks																									
Disturbance																									
Prowlers																									
Ambulance Calls																									
Fire Alarms																									
Lost or Missing																									
Auto Accidents																									
Suicides																									
Autos Stolen																									
Autos Recovered																									
Pick-Ups Reported																									
Pick-Ups Recovered																									
Descriptions																									
Station Calls																									
Other Calls																									
Out of Service																									
Arrests Made																									
TOTALS																									

Annual Consolidated Radio Report

Report of Squad Cars—Year of 1931

	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11	No. 12	No. 13	No. 14	No. 15	No. 16	No. 52	Total
Miscellaneous calls	1330	2242	2039	2226	2303	3369	3640	2120	2272	1553	2218	3646	3321	2456	1247	1715	1625	39322
Arrests on call	31	60	76	79	117	233	256	107	162	62	142	255	217	386	73	135	60	2451
Arrests on tour	25	28	35	35	24	70	80	60	37	44	49	97	61	192	24	61	63	985
Held for investigation	43	38	54	65	49	80	102	130	66	43	68	137	79	133	32	69	31	1219
Arrests on warrant	6	61	51	28	8	52	59	17	35	15	20	69	23	13	11	25	26	519
Subpoenas served	5	30	16	19	13	54	42	31	16	14	15	16	31	15	8	16	5	246
Stolen cars recovered	12	14	20	17	18	33	30	41	20	9	23	45	24	17	13	21	2	359
Burglaries investigated	33	49	69	77	40	52	92	43	47	28	50	66	69	47	25	36	7	830
Holdup investigations	15	52	28	25	24	39	41	24	18	7	15	22	19	21	7	9	4	370
Theft investigations	30	62	51	41	31	44	102	31	42	23	32	52	41	27	29	56	2	696
Streets reported	..	1	6	12	2	3	15	3	8	4	1	3	2	1	2	..	1	64
Accidents attended	62	152	164	201	204	243	291	132	169	113	121	154	144	135	56	96	1649*	4086
Ambulance calls	22	31	32	31	65	82	68	42	65	27	78	108	83	83	41	47	88	993
Coroner calls	2	8	5	8	6	14	12	10	13	6	9	8	9	9	1	11	24	155
Fires attended	35	99	98	67	86	106	171	62	102	68	79	69	63	86	36	59	11	1297
Lost people found	6	14	15	10	16	32	16	16	18	8	10	19	16	19	6	8	211	440
Traffic tags issued	239	825	722	541	199	257	1433	245	148	150	214	548	392	262	239	141	101	6656
Speeding tags issued	25	30	73	97	55	85	249	42	40	22	48	9	5	25	51	55	28	939
Semaphore violations	12	17	19	42	10	29	22	12	6	7	4	14	5	5	15	11	4	234
Street lights reported	25	31	26	32	9	25	18	51	18	52	17	9	5	8	26	29	1	382
Street and traffic signs reported	25	82	90	82	29	130	92	39	28	65	26	47	36	43	28	45	8	895
Doors and windows found open	24	35	37	59	11	25	25	24	18	28	10	17	18	10	14	13	2	370
Dead animals reported	11	27	41	15	22	47	28	21	30	28	26	7	3	8	10	23	1	358
School crossings attended	118	84	96	63	33	187	82	83	104	87	68	8	33	49	123	77	3	1298
Total radio calls	1629	2774	2684	2634	2866	4277	4713	2593	2897	1891	2769	4493	3972	3307	1529	2175	3290	50526
Total miles traveled	41754	49179	51640	47654	42006	48744	47339	47205	51790	37235	42665	29183	28775	34792	35147	38591	39286	712985

* Accident squad makes a report of an accident in conjunction with district squad car.

Respectfully submitted, Lieutenants C. Coulter, R. Doenges, M. Hendrickson, F. Schmidt.

ceiver trouble, and similar data. The nature and content of these daily reports vary considerably among the different departments using them. (See p. 545.)

It is necessary that the radio-equipped police organization keep accurate maintenance record forms covering the servicing of patrol-car receivers, patrol-car transmitters, and the central transmitter. (See p. 546.)

Daily, monthly, and annual consolidated reports covering all radio activities in the department should be prepared promptly and submitted at the specified time. These three forms should be more or less alike in their arrangement of data, so that tabulation of information from daily to monthly reports may be simplified, requiring less time and making error less likely. Likewise, the preparation of the annual report becomes a comparatively simple matter. (See p. 550.)

In addition, general records should be maintained covering the activities of the radio service organization, including records of shop, equipment, tools, radio parts, power consumption, repairs, replacements, purchases, depreciation, and other details necessary to effect a constant check upon the cost of radio operation. Any number of conventional record forms used for this purpose in commercial practice are available and can be easily adapted to the requirements of the service organization. Similar records should be kept concerning the cost of operation and maintenance of beat telephone and recall systems, teletype, and all other communication facilities used by the department. All such records should be routed to the finance or budget officer, so that accurate report summaries of maintenance and operation costs may be prepared for the chief executive.

Definite records should be maintained concerning the personnel of the service department, transmitter operators, and any civilian connected in any way with the maintenance or operation of the police radio system or other communication facilities. Such records properly belong in the custody of the personnel officer of the police department.

APPENDIX 10

Summary of Work Performed by the California State Division of Identification and Investigation

The following data, supplied by C. S. Morrill, Chief of the State Division of Criminal Identification and Investigation, at Sacramento, California, concerning the operation of that unit for the biennium 1934–36, indicate the scope and significance of identification centers in police service.

Report of the Activities of the California State Division of Criminal Identification and Investigation
For the Biennial Period Ending June 30, 1936

BIENNIUM 1934-36
CORRESPONDENCE SECTION

	1934-35	1935-36	Biennium
Correspondence received appertaining to operation and records of criminals	33,960	43,458	77,418
Telegrams received appertaining to operation and records of criminals	108	35	193
Telephone calls received appertaining to operation and records of criminals	1,500	1,517	3,017
Teletype messages received appertaining to operation and records of criminals	2,645	2,808	5,453
Correspondence dispatched in furnishing criminal records and replies to inquiries	63,057	67,535	130,592
Telegrams dispatched in furnishing criminal records and replies to inquiries	123	86	209
Telephone calls dispatched in furnishing criminal records and replies to inquiries	1,354	1,375	2,729
Teletype messages dispatched in furnishing criminal records and replies to inquiries	2,943	3,281	6,224
Bulletins issued relative to operation of migratory offenders	5,280	7,377	12,657

MODUS OPERANDI SECTION

	1934-35	1935-36	Biennium
Circulars received of persons wanted for the commission of crime	6,751	9,105	15,876
Identifications by modus operandi	34	33	67
Geographical index cards filed cross indexing circulars of persons wanted, by departments	6,753	9,212	15,965
Individual files of important cases filed according to peculiar modus operandi	575	508	1,083
Modus operandi cards filed according to particular peculiarities	3,407	4,266	7,673

FINGERPRINT SECTION

	1934-35	1935-36	Biennium
Fingerprints received of persons arrested in California	45,183	55,215	100,398
Fingerprints received of persons arrested outside of California	11,631	14,028	30,659
Fingerprints received of persons committed to Folsom and San Quentin prisons	2,220	1,957	4,177
Fingerprints received for identification only (civil service, solicitors, taxi drivers, etc.)	11,066	17,281	28,347
Fingerprints received of unknown dead for possible identification	230	298	528
Total fingerprints received	75,330	88,779	164,109
Fingerprints discarded	27,654	35,811	63,465
Fingerprints searched and returned (civil service, solicitors, Federal Prohibition, etc.)	3,644	660	4,304
Total fingerprints discarded, returned and unfiled	31,298	36,471	67,769
Total fingerprints filed	44,032	52,308	96,340
Identifications by fingerprints, California departments	15,886	20,608	36,495
Identifications for departments outside of California	3,179	3,909	6,088
Identifications of unknown dead	54	85	139
Verifications by fingerprints where prior records are already shown by arresting department	10,934	12,049	22,983
Criminal photographs received of persons arrested	47,077	53,081	100,158
Anatomical index cards filed recording visible marks and scars	1,501	1,566	3,067
Criminal index cards filed cross indexing criminal records alphabetically under names and aliases	62,842	80,465	143,307
Individual record cards prepared and filed according to chronological arrests	7,283	9,104	16,387

HANDWRITING SECTION

	1934-35	1935-36	Biennium
Questioned documents examined and filed	591	820	1,411
Checks received and copied for future handwriting identifications	6,138	7,788	13,926
Handwriting identifications made from questioned documents	605	641	1,246
Handwriting verifications made from corroborative evidence	2,579	2,386	4,965
Handwriting signatures of habitual check operators filed	486	610	1,096

LOST, STOLEN AND PAWNED PROPERTY SECTION

	1934-35	1935-36	Biennium
Lost, stolen or embezzled articles indexed and filed	7,120	9,567	16,687
Pawned articles indexed and filed	8,325	8,334	16,659
Stolen articles identified, miscellaneous	44	386	430

INVESTIGATION SECTION

	1934-35	1935-36	Biennium
Latent fingerprints received developed at scene of crime	101	105	206
Identification by latent fingerprints	2	.....	2
Cases under investigation during the period	131	169	291
Licenses issued to sell or rent machine guns	2	2	*4
Permits issued to possess machine guns	5	5	10
Licenses issued to sell tear gas	8	16	*24
Permits issued to possess tear gas	26	23	49
Permits issued for permanent installation of tear gas	13	160	173
Dealers record of sale of revolver or pistol indexed and filed	11,223	10,088	21,311

LABORATORY AND RESEARCH SECTION

	1934-35	1935-36	Biennium
Enlargements of photographic evidence	240	253	493
Negatives made of criminal records and evidence	281	369	650
Photographic prints made from negatives	1,360	2,283	3,643
Chemical, ballistic and microscopic examinations	51	76	127

* Annual renewals included.

STATISTICAL SECTION

GATHERED AND COMPILED DATA CONTAINED IN THIS REPORT

TELETYPE SYSTEM

	1934-35	1935-36	Biennium
Station-to-station messages over entire system	178,030	221,312	399,342
All points bulletins	9,753	12,045	21,798
Subjects of all points bulletins:			
Known wanted persons, with descriptions and fingerprint classification	1,527	2,061	3,588
Wanted persons, unknown, with descriptions of selves or vehicles	246	223	469
Missing persons, noncriminal	1,593	1,883	3,476
Stolen property, other than automobiles	805	1,096	1,901
Stolen automobiles	1,618	2,084	3,702
Miscellaneous matters of police information	1,245	1,274	2,519
Cancellations of previous bulletins	2,719	3,424	6,143

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INDEX